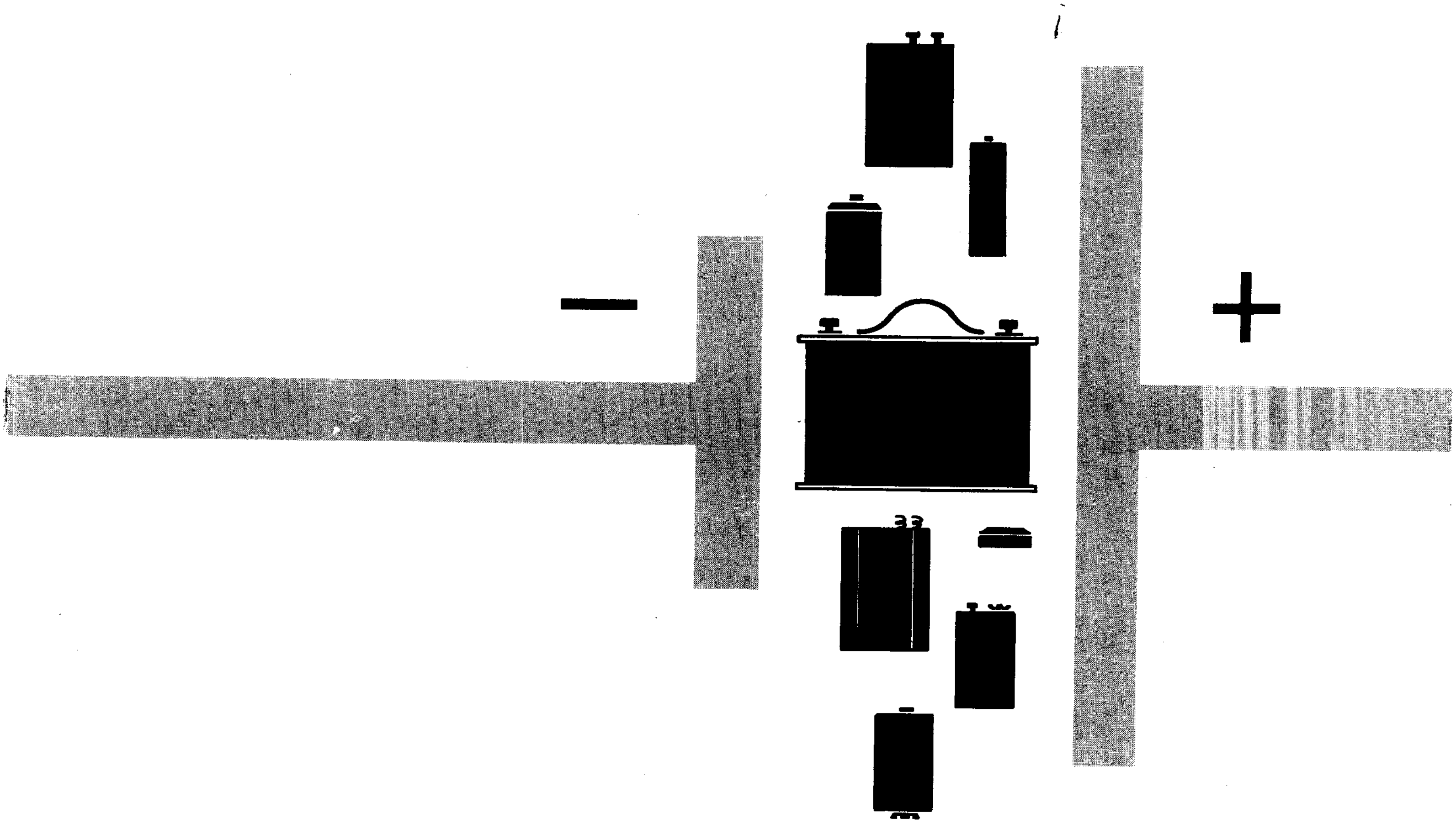
PRICE 50 CENTS*

RCA BATTERY MANUAL

For Industrial and Consumer-Product Applications



THEORY / DESIGN CONSIDERATIONS / CHARACTERISTICS / CLASSIFICATIONS

RADIO CORPORATION OF AMERICA
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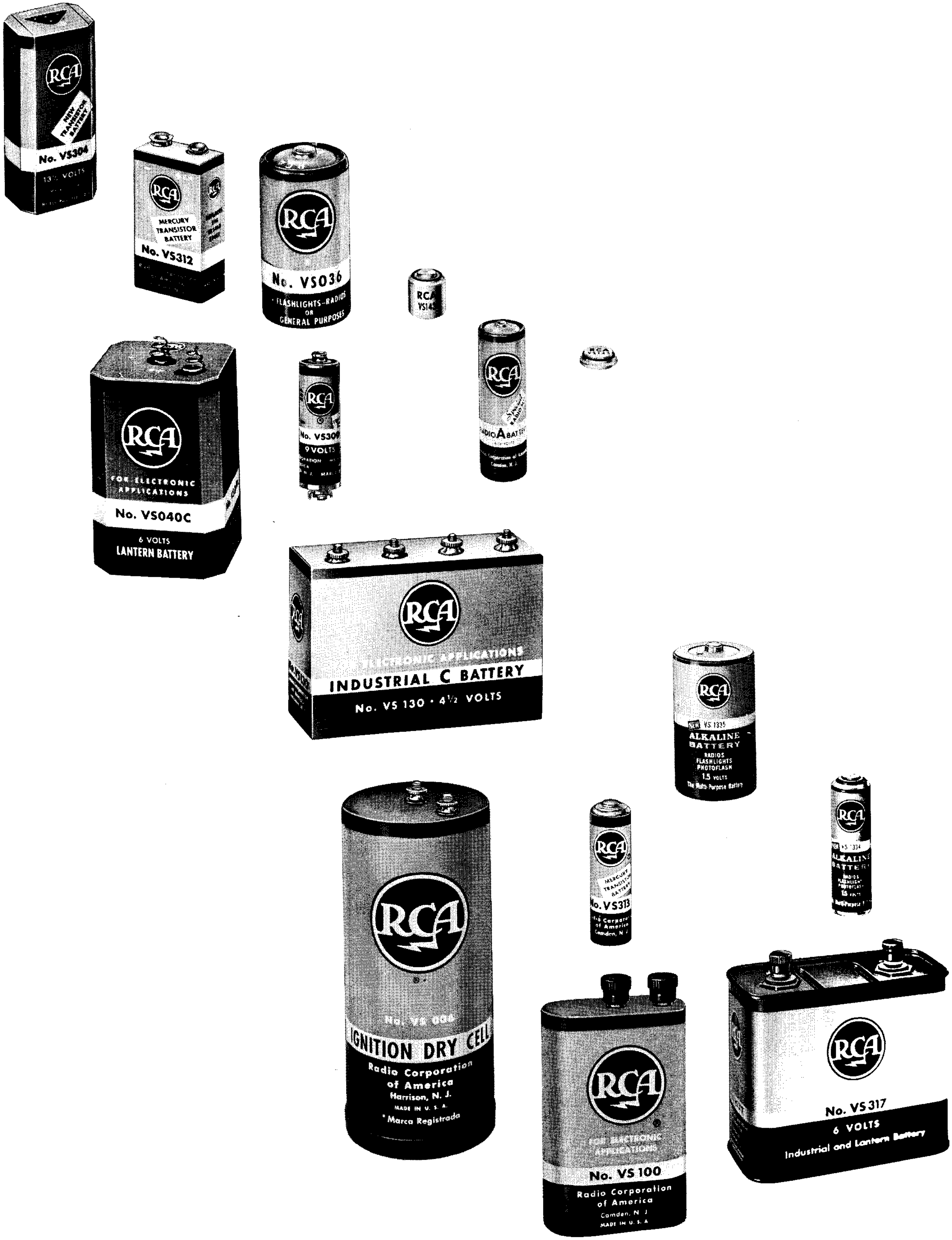

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How to Use the RCA Battery Manual

The RCA Battery Manual contains information on dry cells and batteries (carbon-zinc, mercury, and alkaline types) for the designer, application engineer, experimenter, technician, and student.

Included in this manual are sections on battery theory and applications, electrical and mechanical characteristics, dimensional outlines and terminal connections, as well as a classification chart listing each RCA dry-cell and battery type.

To select the battery type best suited to your application, determine the required voltage and current under load conditions. Select the battery or batteries which meet these requirements from the classification chart. Then determine the lowest closed-circuit voltage or endpoint voltage which will permit the equipment to operate efficiently. For data on the specific battery type which meets your voltage and current requirements refer to the appropriate data group for the electrical characteristics, dimensions, and average hours of service. These data, starting on page 18, are arranged in increasing order of voltage starting with the 1.4-volt types.

SINGLE-VOLTAGE TYPES

Terminal Volts	Suggested Current Range Ma.	Type		
		Mercury	Alkaline	Zinc-Carbon (Leclanché)
1.4	0–7	VS145		
	0–20	VS147		
	0–50	VS150 VS401		
	0–100	VS143		
	0–200	VS313		
	0–250	VS144		
1.5	0–20			VS073 VS074
	0–25			VS034A VS334* VS734†
	0–80			VS035A VS335* VS735†
	0–150		VS1073	VS036 VS336* VS736†
	0–250			VS070
	0–300		VS1334	VS069
	0–500		VS1335	VS101 VS141
	0–1000		VS1336	VS004C VS106
	0–1500			VS006C VS006S
2.8	0–100	VS148		
3	0–25			VS134
	0–250			VS100
	0–500			VS136
	0–1000			VS138

* Special Radio Mix
† For photoflash service

Terminal Volts	Suggested Current Range Ma.	Type		
		Mercury	Alkaline	Zinc-Carbon (Leclanché)
4.2	0–50	VS163		
	0–60	VS400		
	0–100	VS149		
4.5	0–25			VS142
	0–40			VS324
	0–50			VS028 VS133
	0–100		VS1149	
	0–150			VS072
	0–200			VS321
	0–250			VS067
5.6	0–50	VS164		
6	0–25			VS068 VS325
	0–250			VS009 VS040C VS040S
	0–500			VS317
	0–1000			VS103
	0–1500			VS039
7	0–50	VS165		
7.5	0–50			VS129
	0–70			VS065
	0–80			VS315
	0–1000			VS139
8.4	0–30	VS312		
	0–50	VS328		

SINGLE-VOLTAGE TYPES (Continued)

Terminal Volts	Suggested Current Range Ma.	Type		
		Mercury	Alkaline	Zinc-Carbon (Leclanché)
9	0–7			VS327
	0–8			VS323
	0–9			VS300A
	0–15			VS305
	0–20			VS322 VS326
	0–30			VS306
	0–1000			VS140
9.8	0–10	VS309A		
12	0–9			VS329
15	0–1.5			VS704†
	0–2.5			VS083
22.5	0–1.5			VS705†
	0–2.5			VS084
	0–40			VS102

Terminal Volts	Suggested Current Range Ma.	Type		
		Mercury	Alkaline	Zinc-Carbon (Leclanché)
30	0–2.5			VS085
45	0–4			VS086
	0–10			VS055
	0–40			VS013 VS014
	0–70			VS012
67.5	0–3			VS318
	0–6			VS082
	0–8			VS218
	0–10			VS016
75	0–10			VS217
90	0–8			VS219
	0–10			VS090 VS316
300	0–2.5			VS093

† For photoflash service

MULTIPLE-VOLTAGE TYPES

Terminal Volts	Suggested Current Range Ma.	Type		
		Mercury	Alkaline	Zinc-Carbon (Leclanché)
−4.5	0–150			VS130 Taps at −1.5 and −3 volts
−7.5	0–50			VS029 Taps at −1.5, −3, −4.5, and −6 volts
9	0–150			VS301 Taps at 3 and 6 volts
13.5	0–10			VS304 Tap at 9 volts
−22.5	0–50			VS131 Taps at −3, −4.5, −6, −9, −10.5, −16.5, and −17 volts
45	0–20			VS114 Tap at 22.5 volts
	0–25			VS015
	0–50			VS112
	0–250			VS127W
	0–300			VS157W

A-B BATTERY PACKS

Terminal Volts	Suggested Current Range Ma.	Type		
		Mercury	Alkaline	Zinc-Carbon (Leclanché)
A 6 A 7.5 B 75	0–50 0–50 0–12			VS050
A 7.5 B 75	0–50 0–12			VS060
A 1.5 B 90	0–300 0–12			VS022
A 1.5 B 90	0–300 0–14			VS064
A 7.5 A 9 B 90	0–50 0–50 0–12			VS057W VS119
A 7.5 A 9 B 90	0–50 0–50 0–15			VS019
A 9 B 90	0–50 0–12			VS059
A 9 B 90	0–50 0–15			VS047 VS058

Introduction

The battery was the first practical source of electrical energy developed in man's search for portable power sources. Although many other techniques have been developed for supplying electrical power, the battery, which converts chemical energy directly into electrical energy, is still the most widely used source of electrical power when portability is the prime requisite.

The development of semiconductor devices such as transistors, diodes, etc., missiles, satellites, and a great variety of mobile equipment has imposed rigorous demands for power sources which are compact, dimensionally adaptable, able to operate over a wide temperature range, and highly dependable. That the battery meets these demands is proved by the enormous increase in battery use and continuous demands for new battery types.

This manual provides basic information on the structure, chemical composition, and recommended applications of available battery types as well as the effects of environment on these types. This manual also provides a complete reference guide for all RCA batteries, including physical descriptions (dimensions, weight, and terminal connections), electrical characteristics, and service life.

Historical Background

The compact, attractively packaged battery seen on store counters differs considerably from the original "voltaic pile" and "crown of cups" discovered and developed by Allessandro Volta in 1798.

Early experimenters had suspected that there was a relationship between chemical and electrical phenomena. It remained for Volta to confirm this relationship with his scientific disclosures. Volta's original "voltaic pile" consisted of a series of zinc and silver discs separated from each other by a porous non-metallic material and made electrically conductive by being impregnated with salt water. This arrangement produced a voltage across each silver and zinc disc. Volta arranged these discs as shown in Fig. 1.

Another arrangement demonstrated by Volta was the "crown of cups", a group of cups containing salt water, arranged in a circle, and connected to each other by conductors with terminating electrodes of zinc and silver. This arrangement is illustrated in Fig. 2. Both the voltaic pile and the crown of cups were not practical batteries because of their bulk and awkward arrangement of cells.

A major advance in the evolution of the battery was the Daniell cell named for its inventor J. F. Daniell. This cell improved on earlier cells by incorporating a depolarizing agent (a material used to reduce the accumulation of hydrogen on the electrode) which aided in extending the life of the

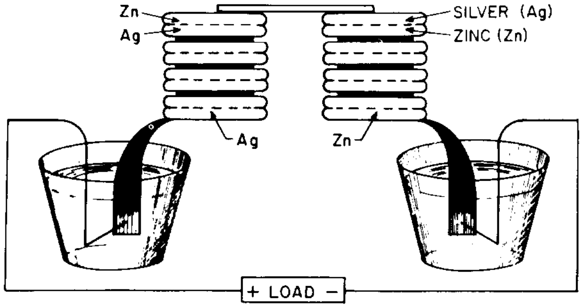


Fig. 1. Voltaic Pile.

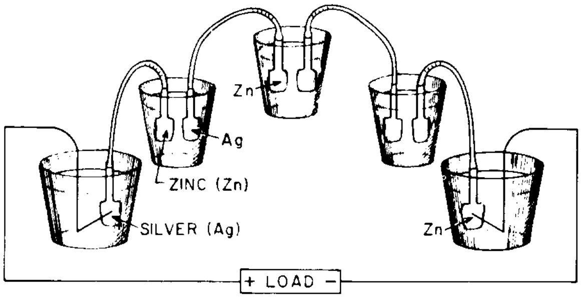


Fig. 2. Volta's Crown of Cups.

Figs. 1 and 2 are illustrations redrawn from Phil. Trans. Roy. Soc., 90 (1800).

cell. The Daniell cell utilized a zinc negative electrode immersed in a dilute acid electrolyte (zinc sulfate + sulfuric acid), and a copper positive electrode immersed in a copper-sulfate solution.

In 1868 Georges Leclanché introduced a cell which was the forerunner of the present dry cell and which has essentially the same chemical constituents as the present cell. Because of these chemical similarities, the dry cell, also called the zinc-carbon cell, is still referred to as a Leclanché-type cell. The Leclanché cell had the desirable feature of employing only one liquid material, an ammonium-chloride (sal-ammoniac) solution which replaced the acid electrolyte used in earlier cells. In addition, the depolarizing solution was replaced by a dry mix composed of manganese dioxide and carbon. Imbedded in the center of this mix was a carbon bar which served both as a current collector and as the positive electrode. Another advantage of the Leclanché cell over the Daniell cell was its higher electromotive force (voltage). Although superior to the Daniell cell the Leclanché cell was still restricted to laboratory and fixed installations because of its liquid content.

The first true dry cell was developed during the period 1886-1888 by Dr. Carl Gassner. This cell used a paste electrolyte composed of zinc oxide, sal ammoniac, and water. The zinc negative electrode was ingeniously modified so that it also served as the container for the cell contents. As in the Leclanché cell, the carbon rod was retained as the positive electrode and located in the center of the battery. To prevent leakage and evaporation, the space between the carbon electrode and the zinc container was sealed at the top with plaster of Paris. The result of these innovations was a far more practical cell which was portable and was adaptable to varying space requirements. Furthermore, several of these cells could be conveniently connected to form batteries for higher voltage and/or current requirements.

Dr. Gassner's development made it practical to manufacture dry cells on a commercial scale. Commercial production of the Gassner cell began in the United States shortly after its announcement. Since then many improvements have been made to increase the life and the current capacity, prevent leakage, and extend the temperature range of this dry cell.

Basic Cell and Battery Types

The terms CELL and BATTERY are often used interchangeably but incorrectly. For example, the popular flashlight "battery" seen on most store counters is not a battery but actually a large 1.5-volt "D" type cell. A cell may be used either singly or two or more cells may be connected together to form a battery. The manner in which cells may be arranged to form batteries is discussed in detail in the next chapter.

This section describes three of the more popular dry-cell types: the Leclanché cell (also known as the zinc-carbon cell), the mercuric oxide or Ruben cell (also known as the mercury cell), and the alkaline cell. A brief description of the wide variety of cells and batteries in use today will give the reader a broader picture of this important source of electrical energy.

Previously we were concerned with the historical development of the dry cell, specifically with zinc-carbon type cells (Leclanché type). To meet the requirements of special industrial and military applications, other types of cells which differ both chemically and structurally from the Leclanché cell have been developed. By varying the composition and quantity of the chemicals of a cell a manufacturer can produce a cell which can handle light current drains for long periods or heavy current drains for short periods. Research is constantly going on to further the development of cells which can handle heavier current drains for longer periods.

Cells are generally classified in two major groups: I) Primary cells which are used until the voltage output is too low for useful work (as in flashlights) and are not rechargeable, and II) Secondary cells or rechargeable cells. The latter are probably best known for their application as automobile batteries. In a secondary cell, chemicals which provide the energy may be restored to their original condition by applying a direct current to the cell in a reverse direction to the flow of current during discharge. Both primary- and secondary-

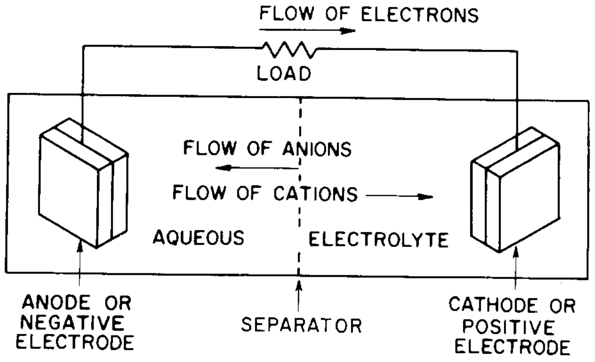


Fig. 3. Representation of a Dry Cell.

type cells contain the following essential elements.

Negative Electrode. The negative electrode is generally a metal such as lead, zinc, iron, or cadmium. These metals are characterized by the ease with which they give up electrons into the external circuit thereby becoming a source of positively charged ions.

Positive Electrode. The positive electrode is generally a chemical compound such as MnO_2, PbO_2, $CuCl$, or $AgCl$ which serves as both the positive electrode and depolarizer. Such compounds are characterized by the ease with which they accept electrons.

Electrolyte. The electrolyte is a solution functioning as an ion-transfer medium between the negative and positive electrodes. In dry cells this solution is in the form of a paste.

Separator. The separator is an inert insulating medium which physically separates the positive and negative electrodes, and at the same time permits the transfer of ions between the electrodes through the electrolyte.

A seal or covering is also employed to prevent the evaporation and spillage of the cell contents, while permitting the escape of gases which can accumulate as a result of the chemical reactions within the cell.

A representation of a cell incorporating these elements and indicating the relative flow of electrons and ions during discharge is shown in Fig. 3.

Primary Cells

Primary cells may be categorized into six significant subgroups as follows:

EMF Standard Cells. These cells use chemicals of very high purity and are designed for use as voltage-reference standards.

Solid-Electrolyte Cells. These cells use only solid materials. The principal advantage of such cells is their long shelf life. Their use, however, is restricted to low-current applications.

Wet Cells. These cells are used principally in signaling and in telephone and telegraph systems, because they can handle relatively large currents. Two of the more popular wet cells produced in this country, the Lalande cell and the zinc "air" cell are activated by adding a caustic-soda electrolyte just prior to use.

Reserve Cells. These cells are designed for use in "one-shot" or "delayed-action" applications. A reserve cell remains essentially inactive in the standby state until required. It is then activated by the addition of a liquid or gas, or by the application of heat.

Dry Cells. This type of cell is the type most widely used and most familiar. In addition to the zinc-manganese dioxide (Leclanché) type, there is the zinc-mercuric oxide (Ruben or mercury) type, the zinc-manganese dioxide (alkaline) type, and several developmental types.

Fuel Cells. The familiar process of burning the fuel to obtain heat energy, which in turn is converted into mechanical energy and then electrical energy, may be replaced eventually by the development of so-called "fuel cells". By adding carbonaceous or hydogen fuels to these cells, a reaction which converts chemical energy directly into electrical energy takes place. These cells are still in the experimental stage.

Secondary Cells

In secondary cells the chemical reactions which produce electrical energy are reversible. The materials used in most commercial secondary cells are lead, cadmium, iron, and zinc for the negative electrode, and lead dioxide, nickel oxide, and silver oxide for the positive electrode. This major group of cells may be classified into the following subgroups: Lead-Acid Cells, Nickel-Iron Cells, Nickel-Cadmium Cells, Zinc-Silver Oxide Cells and Cadmium-Silver Oxide Cells.

Lead-Acid Cells. These are the most widely used secondary cells because they can supply large currents in the order of several hundred amperes at relatively high voltages, approximately 2.1 volts per cell. In a lead-acid cell the negative electrode is a plate of lead; the positive electrode is a plate of lead dioxide. Both electrodes are immersed in an electrolyte consisting of dilute sulfuric acid.

Nickel-Iron Cells. These cells, popularly called Edison or alkaline cells, have useful applications where severe operating conditions are encountered such as in railway service and in other heavy industrial services. In addition, these cells can be discharged for long periods of time or subjected to freezing temperatures without damage. The nickel-iron cell consists of a positive electrode of nickel oxide and a negative electrode of iron and delivers an open-circuit voltage per cell of approximately 1.5 volts.

Nickel-Cadmium Cells. This cell is similar in construction to the nickel-iron type except for its use of cadmium as the negative electrode and slightly lower open-circuit voltage of approximately 1.3 volts. The nickel-cadmium cell can operate satisfactorily under adverse conditions and produces a negligible quantity of gas during inactive periods. Because of the latter feature, these cells may be hermetically sealed to permit greater portability in certain applications.

Zinc-Silver Oxide Cells. These cells employ silver-oxide as the positive electrode and have greater current-handling capacity and higher watt-hour capacity than most secondary cells. Because of their relatively high cost and shorter operating life, zinc-silver oxide cells are not used as extensively as the lead-acid and alkaline cells.

Cadmium-Silver Oxide Cells. These cells employ silver-oxide as the positive electrode for a high watt-hour capacity and cadmium negative electrodes for long operating life. Although cadmium-silver oxide cells do not have as high a watt-hour capacity as zinc-silver oxide cells they have longer operating life and are more useful for low-current applications.

In recent years considerable research has been conducted to develop compact cells having greater capacities and longer life. However, it is not always possible to obtain all desirable features in one cell. Therefore, some degree of compromise in design is necessary to combine the most desirable features in one cell for a particular application.

Chemical Composition and Construction

The preceding sections presented an over-all picture of the development of cell and battery types. This section will cover in greater detail the chemical composition of three types of dry cells having very extensive use in commercial applications. These are the zinc-carbon (Leclanché) cell, the zinc-mercuric oxide (Ruben or mercury) cell, and the zinc-manganese dioxide (alkaline) cell.

The Zinc-Carbon Cell

In the zinc-carbon (Leclanché) cell the zinc case serves as the negative electrode and the container for the cell contents. The material for the positive electrode of this cell is the cathode mix, and because it is a powder it is not a mechanically suitable termination for the positive electrode. To overcome this problem a carbon rod with a large surface area is inserted in the cathode mix. The carbon rod is a good electrical conductor, is chemically inert, and in addition, has a large surface area to provide a low-resistance conducting path. The carbon rod is also porous enough to permit the escape of gases accumulating in the cell but does not permit leakage of the electrolyte material.

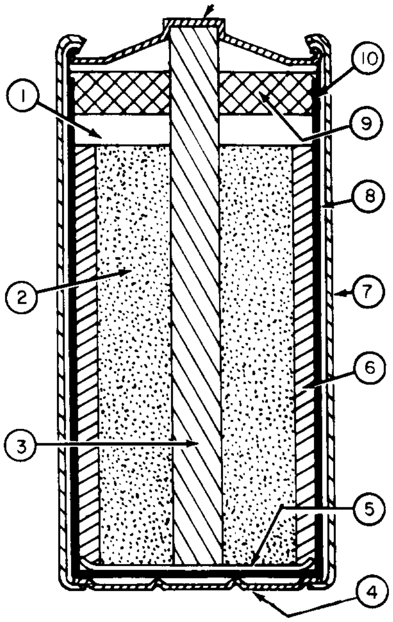
The cathode mix which serves as both the positive electrode and depolarizer, and to some degree as the cell electrolyte, occupies most of the cell interior. Most cathode mixes use graphite or acetylene black to improve electrical conductivity. However, this material plays no part in the chemical reaction. A gelatinous paste composed of corn

Table I

Typical Cathode Mix and Electrolyte Composition of a Zinc-Carbon Dry Cell

Material	Composition in %
Typical Black Mix	
Manganese Dioxide	62
Acetylene black •	8
Zinc Chloride	14
Sal Ammoniac	1
Water	15
	100
Typical Electrolyte	
Ammonium Chloride	9
Zinc Chloride	26
Water	65
	100

• Some mixes use graphite instead of acetylene black.



1. **Air Space**
2. **Manganese-Dioxide-Carbon-Electrolyte Cathode Mix**
3. **Carbon Electrode**
4. **Steel Bottom**
5. **Paper Bottom Washer**
6. **Starch-Flour-Electrolyte Gel Separator**
7. **Steel Jacket**
8. **Laminated Paper Tube**
9. **Pitch Seal**
10. **Zinc Anode Can**

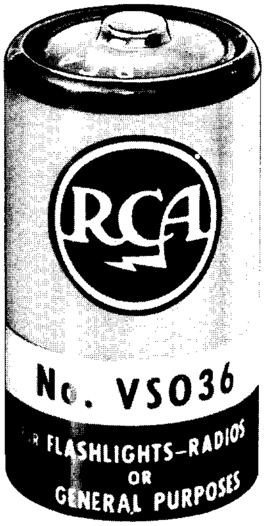


Fig. 4. Cross Section of a Typical Cylindrical Zinc-Carbon Dry Cell.

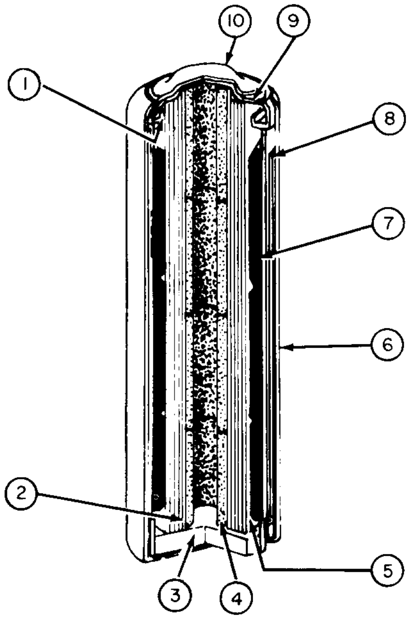
starch and flour, and containing the electrolyte material separates the cathode mix from the zinc can and functions as the ion-transfer medium between the electrodes. Typical examples of the composition of the cathode mix and the electrolyte are shown in Table I.

Finally, to make the dry cell "dry" an insulating material is employed to seal off the cell contents. The seal forms bonds with the cap on the carbon rod and the top rim of the zinc container. This arrangement prevents the solution from spilling and permits the cell to be operated in any position.

An example of a typical zinc-carbon cell showing the construction and chemical composition is shown in Fig. 4.

The Zinc-Mercuric Oxide Cell

The zinc-mercuric oxide cell, popularly known as the mercury cell, uses red mercuric oxide (HgO) for the positive electrode and depolarizer.



1. **Sealing and Insulating Gasket**
2. **Electrolyte Absorbent Separator Material**
3. **Insulator Spacer**
4. **Powdered Zinc Anode**
5. **Microporous Plastic**
6. **Outer Steel Case**
7. **Mercuric Oxide-Graphite Cathode Cylinders**
8. **Absorbent Sleeve**
9. **Tin-plated Steel Inner Top**
10. **Nickel-Plated Steel Outer Top**

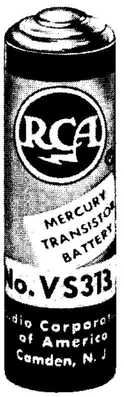
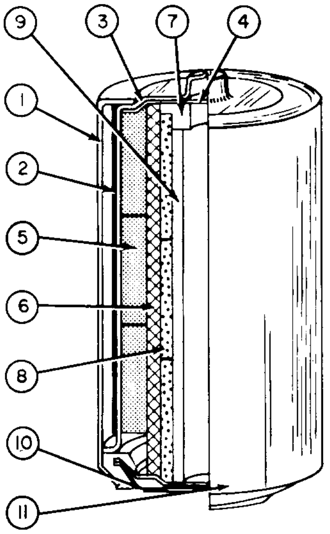


Fig. 5. Cross Section of a Typical Cylindrical Zinc-Mercuric Oxide Dry Cell.



1. **Outer Nickel-Plated Can**
2. **Tube Adapter**
3. **Inner Gold-Plated Can**
4. **Insulator Disk**
5. **Manganese-Dioxide Cathode Cylinders**
6. **Electrolyte Absorbent with Barrier**
7. **Insulating Ring**
8. **Zinc Anode Cylinders**
9. **Inner Absorbent**
10. **Molded Double Top**
11. **Insulating Plastic Jacket**

Fig. 6. Cross Section of a Typical Cylindrical Zinc-Manganese Dioxide Dry Cell.

Graphite is mixed with this material to make it electrically conductive. The negative electrode is a zinc-mercury amalgam, and is separated from the positive electrode by an absorbent pad containing an electrolyte solution of potassium hydroxide (KOH) and zinc oxide (ZnO). In the mercury cell shown in Fig. 5, the powdered-zinc negative electrode makes contact with a plated steel cap which is insulated from the outer steel case. This arrangement makes the cap, or top terminal, negative with respect to the steel casing. Consequently, the polarity of the mercury cell is the reverse of that of the zinc-carbon cell.

Although mercury cells have a lower open-circuit voltage (1.4 volts) than zinc-carbon cells, they have a flatter voltage-time discharge curve. Mercury cells also have a greater watt-hour capacity per unit of volume and weight, and a better shelf-life than zinc-carbon cells.

The Zinc-Manganese Dioxide Cell

Zinc-manganese dioxide cells, commonly known as alkaline cells, are rapidly assuming an important place in the commercial dry-cell industry. Alkaline cells differ from conventional zinc-carbon cells in their electrode structure and in their electrolyte material which is a solution of potassium hydroxide (KOH). Both alkaline cells and zinc-carbon cells have zinc negative electrodes and manganese-dioxide positive electrodes. A typical alkaline cell is shown in Fig. 6.

The alkaline cell has an open-circuit voltage of 1.5 volts with a relatively constant ampere-hour capacity over a wide range of current drains. Although alkaline cells do not have any particular advantage at low current drains, when compared to zinc-carbon cells, they do have higher efficiency at high current drains.

Dry-Cell and Battery Characteristics

The preceding section discussed different types of cells and batteries, their construction and chemical composition. This section will discuss the electrical characteristics of dry cells, such as open-circuit voltages, current capacities, working voltages, and internal resistance. These cell characteristics are determined by the cell contents, the size of the cell, and environmental factors. A knowledge of the characteristics and limitations of dry cells will permit the user to select a battery or cell for a specific job.

Characteristics

Voltage. As stated earlier, the terminal or open-circuit voltage of a cell is determined by its chemical composition. For example, the open-circuit voltage of a typical zinc-carbon cell may vary from about 1.5 volts to 1.6 volts. A desired open-circuit voltage can be obtained simply by connecting two or more cells in a parallel or in a series parallel arrangement. In the parallel arrangement the total open-circuit voltage is the same as for a single cell. However, the current capacity of a battery using a parallel cell arrangement is multiplied by a factor equal to the number of cells. In the series-parallel arrangement both the voltage and current capabilities are increased. The series arrangement increases the open-circuit voltage; the parallel arrangement increases the current handling capability. Fig. 7 shows the three possible battery arrangements.

Internal Resistance. More significant than the open-circuit voltage of a cell is the working voltage or the actual voltage developed when the cell is connected to a load. The working voltage is lower than the open-circuit voltage by an amount equal to the voltage drop in the battery. The difference between the open-circuit voltage and the working voltage of a cell is due to internal resistance. This resistance is always present because conventional cell materials are not perfect electrical conductors. The internal resistance increases with use, storage time and with decreasing temperature. Larger cells have lower internal resistance than smaller ones. Table II shows the approximate internal resistance of several sizes of dry cells.

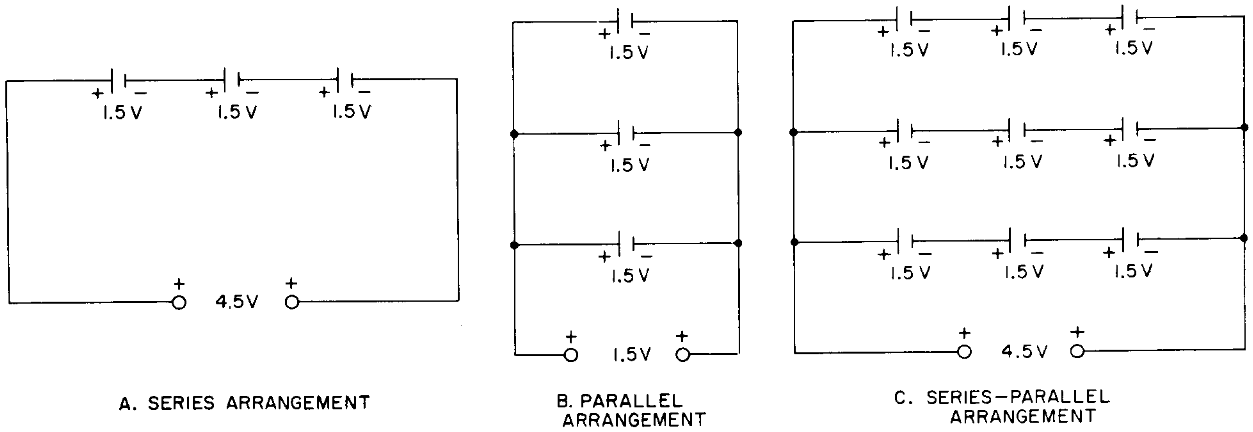
Table II

Approximate Internal Resistance of Zinc-Carbon Dry Cells

Cell Type	Average Flash Current	Internal Resistance
ASA No.	Amperes	Ohms
AA	4.6	0.311
C	5.4	0.284
D	6.6	0.227
F	8.8	0.173
No. 6	32.0	0.038

Primary Batteries—G. W. Vinal—John Wiley and Sons Inc., N. Y.

From a practical point of view, the internal resistance may be neglected when the cell is new and operating at a temperature of about 70°F. As the cell ages, if it is operated continuously, or



A. SERIES ARRANGEMENT

B. PARALLEL ARRANGEMENT

C. SERIES–PARALLEL ARRANGEMENT

Fig. 7. Three Examples of Battery Arrangements Using 1.5-Volt Cells.

if the temperature drops sharply, the internal resistance rises producing a marked effect on the working voltage.

Connecting the cell to the load produces a current through the load and the cell. Because of the increased internal resistance within the cell, the internal voltage drop across this resistance also increases. When the voltage drop becomes excessive the cell becomes useless. Table III shows the ratio of the operating voltage to the open-circuit voltage at different current drains and temperature conditions for a size C cell.

Table III

Initial Voltages of Cell Type No. C, Under Varying Conditions of Temperature and Current Drain

Temperature °F	Cell Type ASA No. C				
	Terminal Volts at Ampere Drains of:				
	Open Circuit	0.03	0.05	0.075	0.15
113	1.57	1.56	1.55	1.54	1.50
70	1.57	1.55	1.53	1.51	1.48
32	1.57	1.51	1.49	1.48	1.43
0	1.57	1.49	1.48	1.46	1.40
—40	0.02	0	0	0	0

Capacity. The capacity of a cell is the ability of the cell to maintain its open-circuit voltage under full-load conditions. The capacity of a cell depends on the load, the cutoff or endpoint voltage, the size of the cell, the shelf-life period, discharge cycle, and on the operating and storage temperatures.

a) Load. The load is the device or equipment to which the cell or battery must deliver power. A cell will deteriorate rapidly if the load requires more power than the cell is designed to supply. On the other hand, a battery used with a load drawing almost negligible current may have a service life almost equal to the battery shelf life.

b) Cutoff or Endpoint Voltage. Endpoint voltage is the closed-circuit voltage below which the equipment will not operate. For a zinc-carbon cell having an open-circuit voltage of approximately 1.5 volts per cell, the endpoint voltage is usually from about 1.1 volts to 0.75 volt.

c) Cell Size. The size or volume of a cell determines the current capacity of the battery in which the cell is used. For cells having the same chemical composition, the larger the cell the greater the capacity. Most zinc-carbon and mercury cells have been standardized, with respect to volume, by the American Standards Association (ASA) under the sponsorship of the National Bureau of Standards. See Table IV.

d) Shelf Life. Shelf life is the length of time that the battery can be stored at room temperature and still retain approximately 90 per cent of its original capacity. All dry cells will deteriorate with time resulting in a loss in cell capacity even though they are not being used. This loss of capacity is due to the loss of moisture in the cell, and an interaction of some of the material within the cell (local action). As a result, less material is available for useful work and, therefore, the service capacity is reduced. The temperatures at which dry cells and batteries are stored also have a marked effect on shelf life: the lower the temperature, the longer the shelf life. For example, A-size zinc-carbon cells stored for 24 months at 21.1°C retained only 50 per cent of their rated capacity, while cells stored at 7.2°C and −17.8°C retained 70 per cent and 90 per cent, respectively of their rated capacity.

e) Discharge Cycle. The discharge cycle is the number of hours the battery is in use during a 24-hour period. In high-drain applications, the service capacity of most cells used two hours a day will be considerably different than that of the same cells used 12 hours a day. This difference occurs because continuous operation does not permit sufficient recovery time for depolarization. The average service hours may be used as a guide in estimating life expectancy. However, these values are average values for large numbers of batteries, and individual batteries may have somewhat different service life. Any change in the discharge cycle will alter the operating life of the battery.

f) Operating and Storage Temperature. One of the most important factors determining the capacity of a cell or battery is the environmental temperature to which it is subjected during discharge and idle periods. Generally, zinc-carbon cells provide optimum performance at normal room temperature 21°C (70°F) with a decrease in open-circuit voltage of about 0.0004 volt per °C over the temperature range of 25°C (77°F) to −20°C (−4°F). These cells become inoperative at about −30°C (−22°F). Table III shows the results of measurements on a C-size zinc-carbon cell under various temperature conditions.

Mercury cells are less efficient than zinc-carbon cells at low temperatures because of a reduction in the chemical activity of the materials used in the cell. Mercury cells are also better adapted for use at moderately high temperatures than at low ones. Table V shows the percentage of service capacity available at temperatures from 0°F, where the cell is completely inoperative, to 140°F.

Table IV

Sizes of Zinc-Carbon and Mercury Dry Cells

ASA Cell Designation No.	Approx. Volume — Cubic Inches	Approx. Weight — Ounces	Nominal Dimensions Inches		
			Length	Width or Diameter	Height of Can or Thickness
Zinc-Carbon Cylindrical Cells					
6	29.5	35.20	—	2-1/2	6
G	4.91	6.40	—	1-1/4	4
F	4.22	5.60	—	1-1/4	3-7/16
D	2.76	3.52	—	1-1/4	2-1/4
CD	2.50	3.20	—	1	3-3/16
C	1.25	1.60	—	15/16	1-13/16
B	0.94	1.23	—	3/4	2-1/8
AA	0.42	0.53	—	17/32	1-7/8
AAA	0.20	0.29	—	25/64	1-11/16
N	0.160	0.19	—	7/16	1-1/16
Zinc-Carbon Flat Cells					
F100	1.74	—	2-3/8	1-25/32	0.41
F90	0.884	—	1-11/16	1-11/16	0.31
F80	0.713	—	1-11/16	1-11/16	0.25
F70	0.638	—	1-45/64	1-45/64	0.22
F60	0.235	—	1-1/4	1-1/4	0.15
F40	0.217	—	1-1/4	27/32	0.21
F30	0.134	—	1-1/4	27/32	0.13
F20	0.055	—	15/16	17/32	0.11
F15	0.032	—	9/16	9/16	0.12
Mercury Cylindrical Cells					
M70	0.60	1.40	—	0.625	1.950
M60	0.50	0.93	—	0.985	0.660
M40	0.20	0.43	—	0.625	0.660
M35	0.20	0.40	—	0.470	1.130
M30	0.13	0.28	—	0.625	0.440
M25	0.09	0.18	—	0.455	0.570
M20	0.07	0.15	—	0.615	0.238
M15	0.03	0.08	—	0.455	0.210
M10	0.02	0.04	—	0.455	0.135

The 100 per cent point, in this table, is the capacity of the cell at 70°F.

Table III and Table V show that dry cells and batteries are most efficient when operated at elevated temperatures. However, the shelf life of cells and batteries is extended when they are stored at lower temperatures, because the chemical reactions which cause deterioration occur at a faster rate at higher temperatures. A test made on zinc-carbon cells, revealed that those stored at 9°C were in better condition at the end of five years than those stored at 40°C after one year.

Tests made at extremely low temperatures indicate that dry cells can be stored at freezing temperatures provided care is taken to avoid moisture condensation on the cells, and provided sufficient time is allowed for the cells to reach room temperature before being placed in service. Excessive moisture will generally destroy the jackets on the cells and increase electrical leakage.

Table V

Effect of Temperature on the Capacity of Zinc-Carbon and Mercury Dry Cells

Zinc Carbon		Mercury	
Temperature °F	(%) of Cell Capacity	Temperature °F	(%) of Cell Capacity
—20	6	0	0
0	27	10	4.5
20	48	20	10
40	69	30	27
60	90	40	58
70	100	50	80
80	115	60	93
100	140	70	100
		80	103
		90	105
		100	106
22.5-volt batteries. F cells discharged through 1250-ohm load.		110	106
		120	105
		130	104
Endpoint = 15 volts		140	103

Primary Batteries — G. W. Vinal — John Wiley and Sons Inc., N. Y.

Testing Batteries

The American Standards Association, with the cooperation of dry-cell manufacturers, has established standard methods for testing dry cells and batteries. A proper test should reflect the kind of service in which the cell will be used. For example, although RCA types VS036 and VS336 cells are both D-size cells and appear identical, they are intended for different types of service. The VS036 is intended for relatively high-current applications, such as flashlights and toys, whereas the VS336 is intended for low-current use such as in transistor applications. Applying the same test to both cells may not give a valid indication of the capacities of the cells. In certain applications, cells which show high-current readings during flash-current tests may not perform as well as other cells which show low-current readings on the same tests.

There are, however, several tests which a user can make to determine the condition of a cell or battery. The simplest of these utilizes a high-impedance voltmeter to measure the working voltage in the equipment in which the battery is used. The user must determine the endpoint voltage of the battery in the equipment. A comparison of the endpoint voltage and the working voltage permits an evaluation of the condition of the battery. When large numbers of batteries are to be tested, an external resistor which presents the same load as the equipment may be used.

Another method may be used when the load presented by the equipment is not known. This method utilizes a resistor which presents a load drawing one-half of the maximum current recommended by the battery manufacturer. For a size D cell, RCA Type VS036, a 10-ohm resistor will present a load of 150 milliamperes. The working voltage of the cell under a 150-milliampere drain will give an indication of the condition of the cell. Commercially available battery testers, such as the RCA WV-37B, may be used to test batteries under load conditions.

These tests cannot be used as a measurement of the remaining useful life of a cell or battery because the remaining useful life is affected by additional factors such as storage time and temperature, and previous operating history. However, a comparison of the measured voltage at a specific current drain — with the manufacturer's data for the same current drain — can provide an approximation of the average number of hours of service life at a specific endpoint voltage.

Recharging Primary Batteries

It is possible to recharge a primary battery[*], but only for a limited number of cycles and under controlled conditions. To be economically practical, battery recharging should be done on a large scale basis. A zinc-carbon battery, before recharging, must have a working voltage not less than 1 volt. The battery should be charged very soon after removal from service. The ampere-hours of recharge should be 120% to 180% of the ampere-hour discharge, and the recharge should take place over a period of 12 to 16 hours. In addition, the battery should be put into service as soon as it has been recharged, since such cells have a very poor shelf life.

Selecting a Battery

The following procedure is a step-by-step method for selecting a battery.

1. Determine the voltage and current requirements of the equipment under load conditions.
2. Determine the endpoint voltage (the lowest closed-circuit voltage which will permit the equipment to operate).
3. Check the Classification Chart on pages 4 and 5 for the RCA batteries which will meet the voltage and current requirements.
4. Data on the appropriate battery types may be found starting on page 18. These data are listed by battery type number starting with the lowest-voltage types. Average service hours for each battery are given on each right-hand facing page. Average service hours are based on current drains and endpoint voltages listed in each chart. In most cases both continuous and intermittent duty data are given.

Because a dry battery is a sealed chemical system, it contains a fixed amount of available energy. Generally, the larger the basic cell, the greater the available energy. Therefore, an increase in cell size can provide higher current capability, longer service life, or both. There are, however, differences between chemical systems. For example, an alkaline cell has a larger current capacity than the same size carbon-zinc or mercury cell, and can provide longer service life at high current drains. Conversely, a mercury cell has longer service life at low current drains than either an alkaline or carbon-zinc cell of the same size.

Several factors in addition to voltage, current, and service requirements must be considered in the selection of a battery type. These factors include size, weight, cost, and availability.

The designer should determine the battery type to be used before the "packaging" of the equipment is made final, and should provide adequate space for the batteries. When possible, it is advisable to use commercially available batteries rather than "custom made" batteries. The use of commercially available batteries results in lower initial costs, reduces storage problems, and simplifies replacements.

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[*] Letter Circular LC965 — U. S. Department of Commerce, National Bureau of Standards.

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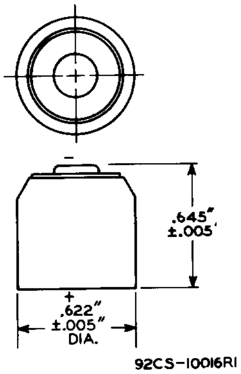
TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
1.4-VOLT BATTERIES								
VS143	0–100	0.45 oz.	Mercury	M40	1	—	Flashlight Type	For miniature transistor devices
VS144	0–250	1.4 oz.	Mercury	M70	1	—	Flashlight Type	For portable dictation equipment
VS145	0–7	0.04 oz.	Mercury	M10	1	—	Flashlight Type	For miniature transistor devices
VS147	0–20	0.17 oz.	Mercury	M20	1	—	Flashlight Type	For miniature transistor radios
VS150	0–50	0.26 oz.	Mercury	M30	1	—	Flashlight Type	For transistorized equipment
VS313	0–200	1.05 oz.	Mercury	*	1	—	Flashlight Type	For transistorized radios and equipment
VS401	0–50	0.40 oz.	Mercury	M35	1	—	Flashlight Type	For transistor radios

DIMENSIONAL OUTLINES



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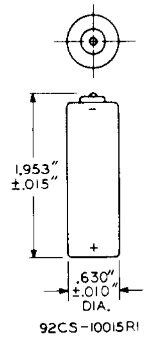

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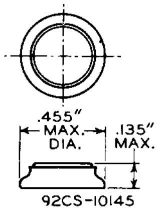

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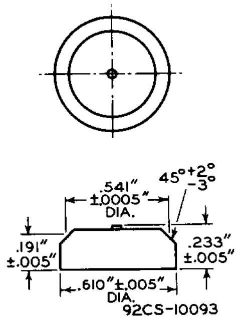

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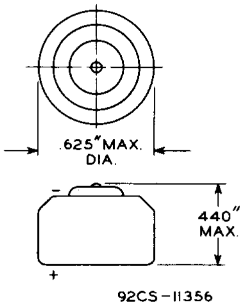

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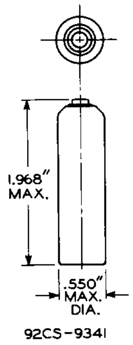

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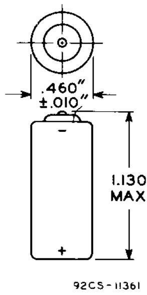

VS401

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*No comparable ASA number.

HOURS OF SERVICE

at 70°F

VS143

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		21 ma.	25 ma.	30 ma.	50 ma.	
Contin-uous	0.8	50	40.5	33	20.5	
	0.9	49.5	40	32.5	20	
	1	49	39	32	19	
	1.1	48	37.5	30.5	16	
	1.2	45	17	10	1	

VS144

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		30 ma.	40 ma.	50 ma.	125 ma.	250 ma.
Contin-uous	0.8	121	91	73.5	28	10
	0.9	120	90	73	27	9
	1	119	88	72	26	7
	1.1	117	85	70	21	3
	1.2	109	75	55	4	—

VS145

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		0.95 ma.	2.0 ma.	4 ma.		
Contin-uous	0.9	80	37.5	18		
	1	79.5	37	17.5		
	1.1	79	36	16.5		
	1.2	75	26	9		
	1.3	8	1	—		

VS147

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		2.5 ma.	5 ma.	10 ma.		
Contin-uous	0.9	100	50	25		
	1	98	48	24		
	1.1	96	46	23		
	1.2	91	24	17		
	1.3	4	—	—		

VS150

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		2 ma.	3 ma.	5 ma.	10 ma.	25 ma.
Contin-uous	0.9	250	165	100	50	20
	1	247	164	99	49	18
	1.1	244	160	97	46.5	14.5
	1.2	235	155	94	42	4
	1.3	100	70	24	5.5	—

VS313

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		5 ma.	15 ma.	20 ma.	25 ma.	50 ma.
Contin-uous	0.9	480	161	120	100	47
	1	478	160	118	95	45
	1.1	470	155	109	85	41
	1.2	460	140	85	50	10
	1.3	432	55	20	10	—

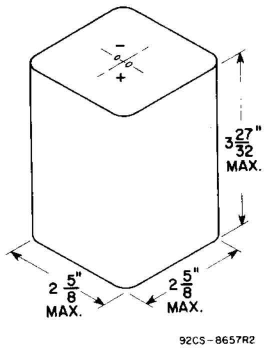
VS401

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		12.5 ma.	25 ma.	50 ma.		
Contin-uous	0.9	65	33	14		
	1	64	32	13		
	1.1	63	30	8		
	1.2	60	18	3		
	1.3	12	0.2	—		

TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
1.5-VOLT BATTERIES								
VS004	0–1000	1 lb 6 oz.	Leclanché	F	4	Parallel	Plug-In Socket (ASA No. I)	Portable "A"
VS006C	0–1500	2 lbs 1 oz.	Leclanché	6	1	—	Spring-Clip (Fahnestock)	For telephone service
VS006S	0–1500	2 lbs 1 oz.	Leclanché	6	1	—	Screw (8-32 Thread) and Knurled Nut	For ignition service
VS034A	0–25	0.6 oz.	Leclanché	AA	1	—	Flashlight Type	For penlight flashlights and toys
VS035A	0–80	1.4 oz.	Leclanché	C	1	—	Flashlight Type	For baby flashlight and toys
VS036	0–150	3 oz.	Leclanché	D	1	—	Flashlight Type	For standard-size flashlights and toys

1.5-volt types continued on pages 22 and 23.

DIMENSIONAL OUTLINES



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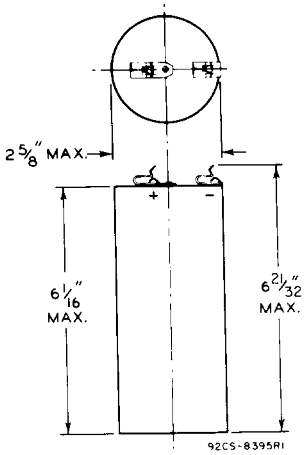

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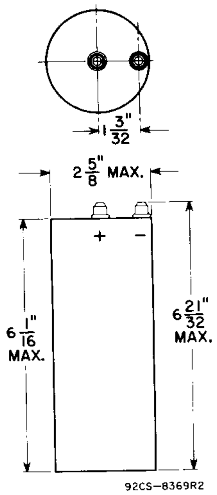

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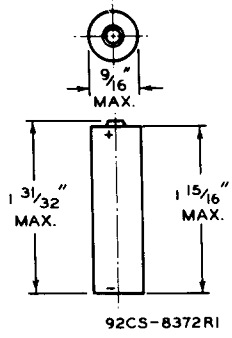

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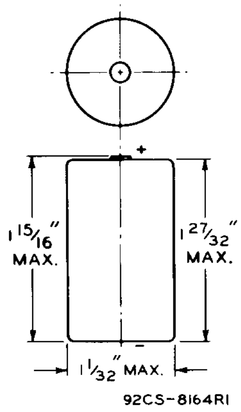

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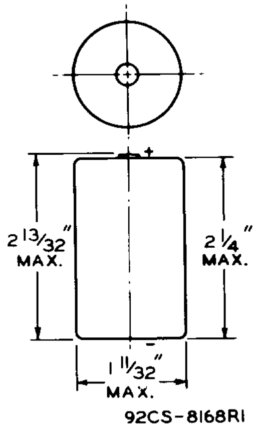
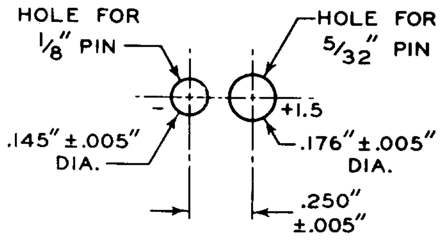


SOCKET PATTERN



VS004

HOURS OF SERVICE
at 70°F

VS004

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		40 ma.	80 ma.	400 ma.	800 ma.	1200 ma.
Contin-uous	0.8	1200	550	84	33	18
	0.9	1050	470	70	26	14
	1	940	390	55	20	10
	1.1	880	335	40	13	6.5
	1.2	620	260	25	8	4
4 hrs/ day	0.8	940	475	90	35	19
	0.9	880	425	75	28	15
	1	840	400	56	22	12
	1.1	760	335	44	16	8.5
	1.2	680	300	36	12	4

VS006C

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		60 ma.	100 ma.	200 ma.	400 ma.	600 ma.
Contin-uous	0.8	1078	550	210	74	39
	0.9	980	500	190	65	33
	1	868	450	170	55	29
	1.1	726	350	125	40	20
	1.2	566	260	74	20	9
4 hrs/ day	0.8	817	530	275	125	68
	0.9	760	470	230	100	55
	1	713	410	185	78	43
	1.1	665	370	160	60	32
	1.2	540	300	115	40	20

VS006S

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		60 ma.	100 ma.	200 ma.	400 ma.	600 ma.
Contin-uous	0.8	1078	550	210	74	39
	0.9	980	500	190	65	33
	1	868	450	170	55	29
	1.1	726	350	125	40	20
	1.2	566	260	74	20	9
4 hrs/ day	0.8	817	530	275	125	68
	0.9	760	470	230	100	55
	1	713	410	185	78	43
	1.1	665	370	160	60	32
	1.2	540	300	115	40	20

VS034A

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	10 ma.	20 ma.	50 ma.
Contin-uous	0.8	1440	220	94	37	10
	0.9	1250	200	80	30	8.5
	1	1180	160	66	25	7
	1.1	1040	130	52	19	4.8
	1.2	700	90	35	11	2.8
2 hrs/ day	0.8	—	265	125	54	14
	0.9	—	255	120	50	12
	1	—	240	110	46	10
	1.1	—	210	92	36	8
	1.2	—	145	60	22	3.8

VS035A

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	50 ma.	100 ma.
Contin-uous	0.8	700	320	140	40	14
	0.9	620	270	115	33	11
	1	540	220	90	23	8
	1.1	440	170	64	17	6
	1.2	340	130	50	11	3.5
4 hrs/ day	0.8	620	310	150	52	20
	0.9	580	280	130	42	14
	1	540	240	110	33	10
	1.1	460	210	88	25	7
	1.2	360	150	62	15	3.5

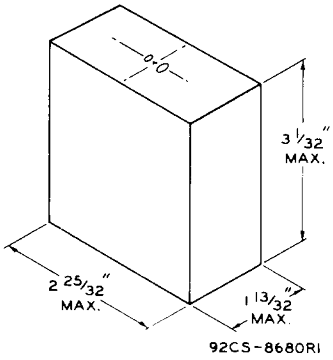
VS036

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	20 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	0.8	1050	360	32	12	6
	0.9	745	260	24	8.5	4.5
	1	600	210	19	6.5	3.5
	1.1	500	165	14	4.5	3
	1.2	370	125	9.6	3.2	2
4 hrs/ day	0.8	660	330	50	18	8
	0.9	620	310	41	14	6
	1	580	290	36	12	3.5
	1.1	530	260	30	9	3
	1.2	470	230	22	5.2	2

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
1.5-VOLT BATTERIES								
VS069	0–300	6.5 oz.	Leclanché	D	2	Parallel	Plug-In Socket (ASA No. I)	Portable "A"
VS070	0–250	5 oz.	Leclanché	F	1	—	Plug-In Socket (ASA No. I)	Portable "A"
VS073	0–20	0.22 oz.	Leclanché	N	1	—	Flashlight Type	For key-chain lights and other novelties
VS074	0–20	0.3 oz.	Leclanché	AAA	1	—	Flashlight Type	For flashlights, toys, and other novelties
VS101	0–500	12 oz.	Leclanché	F	2	Parallel	Screw (8-32 Thread) and Knurled Nut	For instruments and test equipment
VS106	0–1000	1 lb 7 oz.	Leclanché	F	4	Parallel	Screw (8-32 Thread) and Knurled Nut	For instruments, test equipment and hobby use

1.5-volt types continued on pages 24 and 25.

DIMENSIONAL OUTLINES



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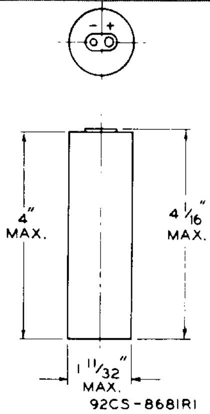

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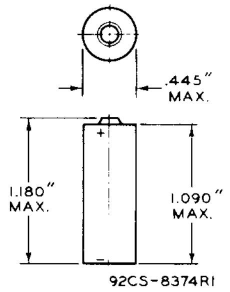

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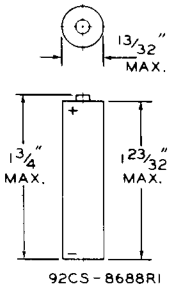

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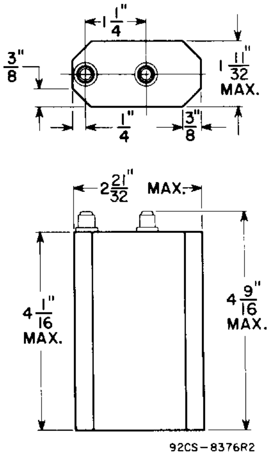

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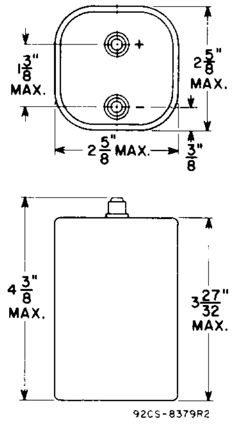
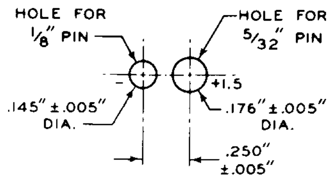


VS106

SOCKET PATTERN



VS069
VS070

HOURS OF SERVICE

at 70°F

VS069

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		20 ma.	60 ma.	100 ma.	200 ma.	600 ma.
Contin-uous	0.8	600	180	100	43	8.5
	0.9	540	157	84	35	6.5
	1	495	138	72	29	5
	1.1	425	123	63	25	3.6
	1.2	380	100	49	18	1.7
4 hrs/ day	0.8	580	190	115	48	9
	0.9	560	185	97	41	7
	1	530	165	86	34	5
	1.1	495	150	72	29	3.6
	1.2	385	120	57	20	1.7

VS070

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	0.8	1200	350	84	33	18
	0.9	1050	275	70	26	14
	1	940	250	55	20	10
	1.1	880	220	40	13	6.5
	1.2	620	155	25	8	4
4 hrs/ day	0.8	940	320	90	35	19
	0.9	880	275	75	28	15
	1	840	260	56	22	12
	1.1	760	235	44	16	8.5
	1.2	680	180	36	12	4

VS073

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	20 ma.	30 ma.	100 ma.
Contin-uous	0.8	485	84	15	8	1.8
	0.9	455	80	13	7.5	1.6
	1	435	72	12	6.5	1.2
	1.1	405	65	11	6	0.8
	1.2	370	56	9	4.7	0.6
2 hrs/ day	0.8	485	94	22	13	1.8
	0.9	460	88	18	11	1.6
	1	440	81	16	9.5	1.2
	1.1	410	71	14	7.5	0.8
	1.2	360	60	11	5.5	0.5

VS074

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		2 ma.	5 ma.	10 ma.	20 ma.	50 ma.
Contin-uous	0.8	320	135	40	15	4.2
	0.9	270	108	30	12	3.2
	1	235	90	24	11	2.3
	1.1	195	73	19	8	1.7
	1.2	155	55	14	6	1.1
2 hrs/ day	0.8	350	128	54	21	5.5
	0.9	320	118	47	18	4.5
	1	300	108	43	15	3.5
	1.1	270	97	39	13	1.7
	1.2	250	80	32	10	1.1

VS101

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		20 ma.	60 ma.	200 ma.	400 ma.	600 ma.
Contin-uous	0.8	1200	350	84	33	18
	0.9	1050	275	70	26	14
	1	940	250	55	20	10
	1.1	880	220	40	13	6.5
	1.2	620	155	25	8	4
4 hrs/ day	0.8	940	320	90	35	19
	0.9	880	275	75	28	15
	1	840	260	56	22	12
	1.1	760	235	44	16	8.5
	1.2	680	180	36	12	4

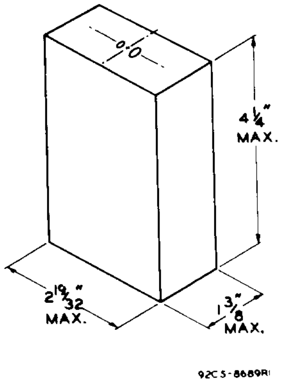
VS106

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		40 ma.	120 ma.	400 ma.	800 ma.	1200 ma.
Contin-uous	0.8	1200	350	84	33	18
	0.9	1050	275	70	26	14
	1	940	250	55	20	10
	1.1	880	220	40	13	6.5
	1.2	620	155	25	8	4
4 hrs/ day	0.8	940	320	90	35	19
	0.9	880	275	75	28	15
	1	840	260	56	22	12.5
	1.1	760	235	44	16	8.5
	1.2	680	180	36	12	4

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
1.5-VOLT BATTERIES								
VS141	0-500	12.5 oz.	Leclanché	F	2	Parallel	Plug-In Socket (ASA No. I)	Portable "A"
VS236	0-300	5.9 oz.	Leclanché	G	1	—	Flashlight Type	Portable "A"
VS334	0-25	0.6 oz.	Leclanché	AA	1	—	Flashlight Type	For transistor radios
VS335	0-80	1.4 oz.	Leclanché	C	1	—	Flashlight Type	For portable radios
VS336	0-150	3.3 oz.	Leclanché	D	1	—	Flashlight Type	For portable radios
VS734	0-25	0.6 oz.	Leclanché	AA	1	—	Flashlight Type	For photoflash service

1.5-volt types continued on pages 26 and 27.

DIMENSIONAL OUTLINES



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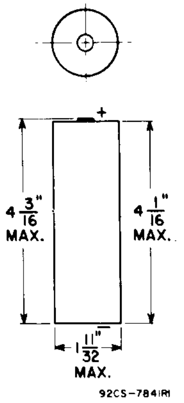

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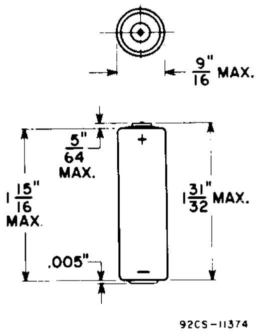

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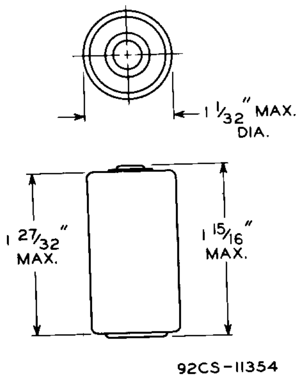

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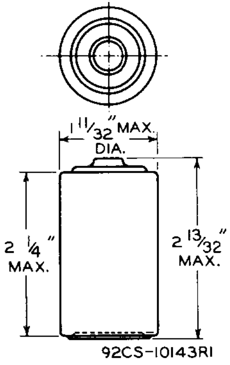

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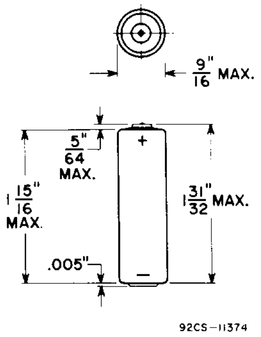
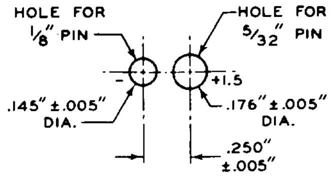


VS734

SOCKET PATTERN



VS141

HOURS OF SERVICE

at 70°F

VS141

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		20 ma.	60 ma.	200 ma.	400 ma.	600 ma.
Contin-uous	0.8	1200	350	84	33	18
	0.9	1050	275	70	26	14
	1	940	250	55	20	10
	1.1	880	220	40	13	6.5
	1.2	620	155	25	8	4
4 hrs/ day	0.8	940	320	90	35	19
	0.9	880	275	75	28	15
	1	840	260	56	22	12.5
	1.1	760	235	44	16	8.5
	1.2	680	180	36	12	4

VS236

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	300 ma.	500 ma.
Contin-uous	0.8	1800	500	90	15	—
	0.9	1600	420	78	12	—
	1	1450	350	66	11	—
	1.1	1250	285	47	7	—
	1.2	1000	215	32	4.8	—
4 hrs/ day	0.8	1500	520	130	27	12
	0.9	1400	460	110	23	9.5
	1	1300	420	94	19	7
	1.1	1200	380	84	16	6
	1.2	1100	330	70	11	3

VS334

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	30 ma.	100 ma.
Contin-uous	0.8	270	117	49	28	5
	0.9	255	110	45	26	4.5
	1	230	98	40	23	4
	1.1	210	88	34	19	3
	1.2	185	74	28	16	2.3
2 hrs/ day	0.8	290	145	72	45	8.5
	0.9	285	140	68	43	7
	1	275	135	64	39	6
	1.1	270	130	60	35	4
	1.2	250	115	49	27	2.5

VS335

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			60 ma.	80 ma.	120 ma.	160 ma.
2 hrs/ day	1	25	50	—	—	—
	1	18.8	—	32	—	—
	1	12.5	—	—	20	—
	1	9.4	—	—	—	9

VS336

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			60 ma.	150 ma.	300 ma.	
2 hrs/ day	1	25	95	—	—	
	1	10	—	30	—	
	1	5	—	—	8.5	

VS734

Duty Cycle	End-point Volts	Battery Load Ohms	Number of Flashes and Average Service Hours At Indicated Initial Current Drains			
			375 ma.	No. of flashes		
See Note 1	0.25	0.15	—	500		
Continuous	0.75	4	0.6	—		
See Note 2	0.75	4	2	—		
See Note 3	0.9	4	1	—		

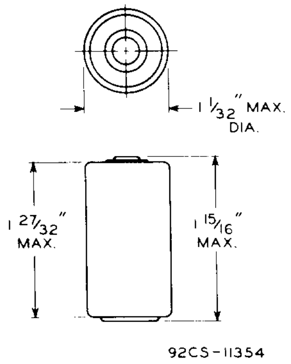
Note 1 — ASA Photoflash Test: Discharge one second each minute for one hour at 24 hour intervals for five days per week.

Note 2 — Household Intermittent Test: Discharge for five minute periods at 24 hour intervals.

Note 3 — Light-Industrial Flashlight Test: Four minutes per hour at intervals of eight hours per day with 16-hour rest periods.

TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
1.5-VOLT BATTERIES								
VS735	0–80	1.4 oz.	Leclanché	C	1	—	Flashlight Type	For photoflash service
VS736	0–150	3.3 oz.	Leclanché	D	1	—	Flashlight Type	For photoflash service
VS1073	0–150	0.3 oz.	Alkaline	N	1	—	Flashlight Type	Multipurpose type—for use in radio, flashlight, and photoflash service
VS1334	0–300	0.9 oz.	Alkaline	AA	1	—	Flashlight Type	Multipurpose type—for use in radio, flashlight, test equipment, medical instrument, and photoflash service
VS1335	0–500	2.4 oz.	Alkaline	C	1	—	Flashlight Type	Multipurpose type—for use in radio, flashlight, test equipment, electric toy, and photoflash service
VS1336	0–1000	5.26 oz.	Alkaline	D	1	—	Flashlight Type	Multipurpose type—for use in radio, flashlight, test equipment, electric toy, photoflash, and other heavy-duty applications

DIMENSIONAL OUTLINES



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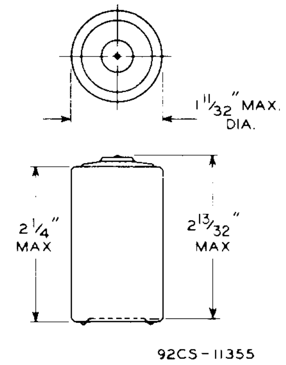

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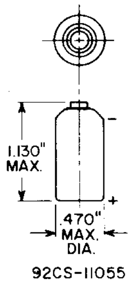
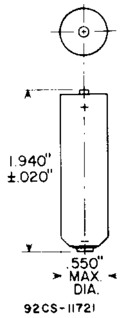


VS1073



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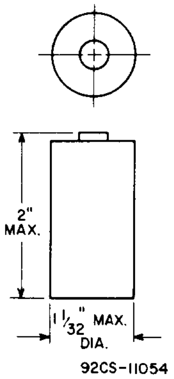

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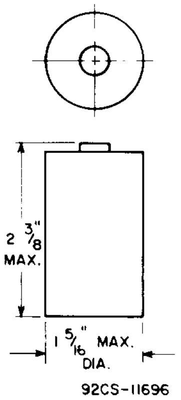


VS1336

HOURS OF SERVICE

at 70°F

VS735

Duty Cycle	End-point Volts	Battery Load Ohms	Number of Flashes and Average Service Hours At Indicated Initial Current Drains			
			275 ma.	375 ma.	No. of flashes	
See Note 1	0.25	0.15	—	—	1400	
Continuous	0.75	4	—	1.75	—	
See Note 2	0.75	4	4	—	—	
See Note 3	0.9	4	—	2	—	

Note 1 — ASA Photoflash Test: Discharge one second each minute for one hour at 24 hour intervals for five days per week.

Note 2 — Household Intermittent Test: Discharge for five minute periods at 24 hour intervals.

Note 3 — Light Industrial Flashlight Test: Discharge for four minutes per hour at intervals of eight hours per day with 16-hour rest periods.

VS736

Duty Cycle	End-point Volts	Battery Load Ohms	Number of Flashes and Average Service Hours At Indicated Initial Current Drains			
			375 ma.	No. of flashes		
See Note 1	0.5	0.15	—	1700		
Continuous	0.75	4	5	—		
See Note 2	0.9	4	6.5	—		
See Note 3	0.9	4	7	—		
See Note 2	1.1	4	4	—		

Note 1 — ASA Photoflash Test: Discharge one second each minute for one hour at 24 hour intervals for five days per week.

Note 2 — Heavy Industrial Flashlight Test: Discharge for four minute periods at 15 minute intervals for eight hours per day with 16-hour rest periods.

Note 3 — Light Industrial Flashlight Test: Discharge for four minutes per hour at intervals of eight hours per day with 16-hour rest periods.

VS1073

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		5 ma.	10 ma.	15 ma.	25 ma.	100 ma.
Contin-uous	0.8	161	77	44	26	2.75
	0.9	138	64	37	20	2.6
	1	113	50	26	15	2.25
	1.1	90	37	18	10	1.2
	1.2	63	24	10	5	0.5

VS1334

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		25 ma.	50 ma.	125 ma.	250 ma.	
Contin-uous	0.8	81	38	10	5	
	0.9	67	32	8	3.5	
	1	49	25	5	2	
	1.1	31	16	3	1	
	1.2	15	7	1.5	0.5	

VS1335

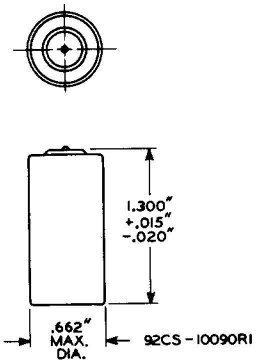
Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indicated Initial Current Drains				
		83 ma.	125 ma.	250 ma.		
Contin-uous	0.8	68	44	15		
	0.9	50	34	11		
	1	36	25	7		
	1.1	22	17	3		
	1.2	12	10	1		

VS1336

Duty Cycle	End-point Volts	Average Service Hours At 1.25 Volts And Indictaed Initial Current Drains				
		63 ma.	83 ma.	125 ma.	250 ma.	
Contin-uous	0.8	237	176	106	45	
	0.9	204	149	86	38	
	1	164	120	63	28.5	
	1.1	120	86	40	15	
	1.2	70	50	18	6	

TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
2.8-VOLT BATTERY								
VS148	0–100	0.9 oz.	Mercury	M40	2	Series	Flashlight Type	For personal paging devices
3-VOLT BATTERIES								
VS100	0–250	12 oz.	Leclanché	F	2	Series	Screw (8-32 Thread) and Knurled Nut	For use in radio and test equipment
VS134	0–25	1.5 oz.	Leclanché	AA	2	Series	Flat-Spring	For flat flashlights
VS136	0–500	1 lb 6 oz.	Leclanché	F	4	Series-Parallel	Screw (8-32 Thread) and Knurled Nut	For radio and industrial "A" applications
VS138	0–1000	2 lbs 12 oz.	Leclanché	F	8	Series-Parallel	Spring-Clip (Fahnestock)	For telephone service

DIMENSIONAL OUTLINES



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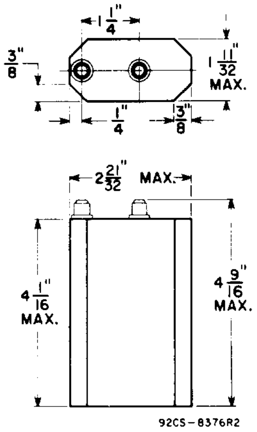

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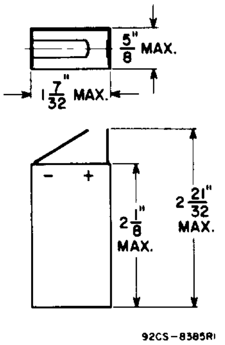

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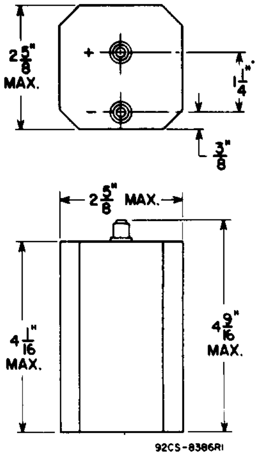

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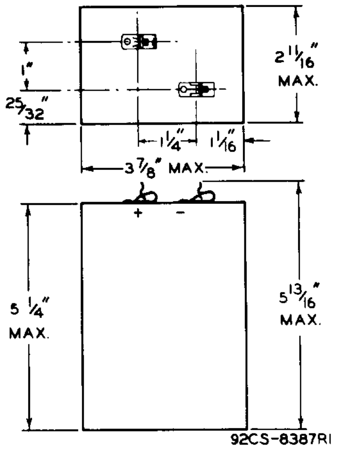


VS138

HOURS OF SERVICE

at 70°F

VS148

Duty Cycle	End-Point Volts	Average Service Hours At 2.5 Volts And Indicated Initial Current Drains				
		21 ma.	30 ma.	50 ma.	83 ma.	
Contin-uous	1.8	48.5	33.2	20	11.5	
	2	48	33	19.5	11	
	2.2	47	29	17	7	
	2.4	41.5	18	2	—	
	2.5	20	3	—	—	

VS100

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	1.6	1200	350	84	33	18
	1.8	1050	275	70	26	14
	2	940	250	55	20	10
	2.2	880	220	40	13	6.5
	2.4	620	155	25	8	4
4 hrs/ day	1.6	940	320	90	35	19
	1.8	880	275	75	28	15
	2	840	260	56	22	12
	2.2	760	235	44	16	8.5
	2.4	680	180	36	12	4

VS134

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	30 ma.	50 ma.
Contin-uous	1.6	220	94	37	20	10
	1.8	200	80	30	16	8.5
	2	160	66	25	13	7
	2.2	130	52	19	9	4.8
	2.4	90	35	11	6.5	2.8
2 hrs/ day	1.6	265	225	54	32	14
	1.8	255	120	50	28	12
	2	240	110	46	25	10
	2.2	210	92	36	20	8
	2.4	145	60	22	11	3.8

VS136

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		20 ma.	60 ma.	200 ma.	400 ma.	600 ma.
Contin-uous	1.6	1200	350	84	33	18
	1.8	1050	275	70	26	14
	2	940	250	55	20	10
	2.2	880	220	40	13	6.5
	2.4	620	155	25	8	4
4 hrs/ day	1.6	940	320	90	35	19
	1.8	880	275	75	28	15
	2	840	260	56	22	12
	2.2	760	235	44	16	8.5
	2.4	680	180	36	12	4

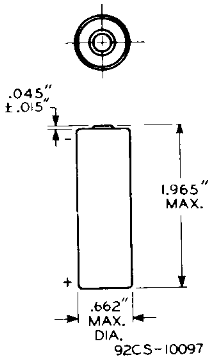
VS138

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		40 ma.	120 ma.	400 ma.	800 ma.	1200 ma.
Contin-uous	1.6	1200	350	84	33	18
	1.8	1050	275	70	26	14
	2	940	250	55	20	10
	2.2	880	220	40	13	6.5
	2.4	620	155	25	8	4
4 hrs/ day	1.6	940	320	90	35	19
	1.8	880	275	75	28	15
	2	840	260	56	22	12
	2.2	760	235	44	16	8.5
	2.4	680	180	36	12	4

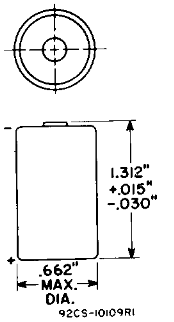
RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
4.2-VOLT BATTERIES								
VS149	0–100	1.4 oz.	Mercury	M40	3	Series	Flashlight Type	For radiation detection and paging devices
VS163	0–50	0.87 oz.	Mercury	M30	3	Series	Flashlight Type	For transistor devices
VS400	0–60	3 oz.	Mercury	M60	3	Series	Flashlight Type	For transistor radios and for stable bias-voltage supply in transistorized equipment
4.5-VOLT BATTERIES								
VS028	0–50	4 oz.	Leclanché	B	3	Series	Screw (8-32 Thread) and Knurled Nut	For portable bias-voltage applications
VS067	0–250	1 lb.	Leclanché	F	3	Series	Plug-In Socket (ASA No. III)	Portable "A"
VS072	0–150	10.5 oz.	Leclanché	D	3	Series	Plug-In Socket (ASA III)	Portable "A"

4.5-volt types continued on pages 32 and 33.

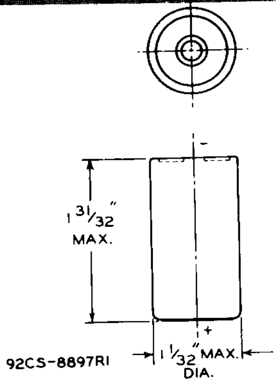
DIMENSIONAL OUTLINES



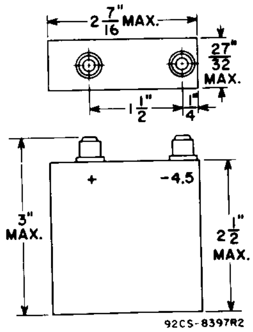
VS149



VS163



VS400



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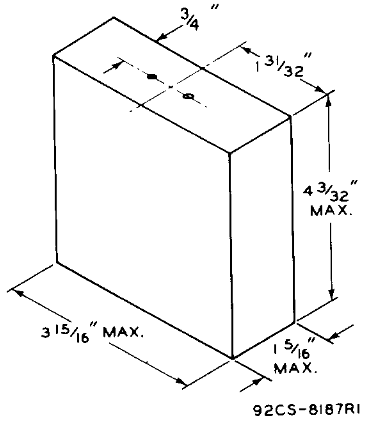

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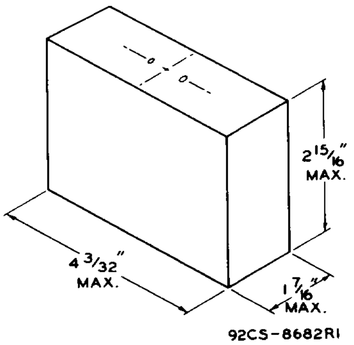
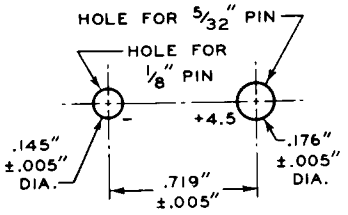


VS072

SOCKET PATTERN



VS067 **VS072**

HOURS OF SERVICE

at 70°F

VS149

Duty Cycle	End-point Volts	Average Service Hours At 3.75 Volts And Indicated Initial Current Drains				
		21 ma.	30 ma.	50 ma.		
Contin-uous	2.4	49	34	20		
	2.7	48.5	33	19.8		
	3	48	32	19		
	3.3	47	30	16.5		
	3.6	42	17	2.5		

VS163

Duty Cycle	End-point Volts	Average Service Hours At 3.75 Volts And Indicated Initial Current Drains				
		15.5 ma.	25 ma.	50 ma.		
Contin-uous	2.7	33	20	8.2		
	2.9	32.5	19	7.5		
	3.1	31.5	18	5		
	3.3	30	16	3		
	3.5	18.5	9	1.5		

VS400

Duty Cycle	End-point Volts	Average Service Hours At 3.75 Volts And Indicated Initial Current Drains				
		21 ma.	25 ma.	31 ma.	42 ma.	50 ma.
Contin-uous	2.4	106	88	69	50	43
	2.7	104	86	67	48	40
	3	101	84	64	44	29
	3.3	94	70	46	23	9.5
	3.6	30	16	12	6	—

VS028

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	50 ma.	100 ma.
Contin-uous	2.4	610	205	87	26	10
	2.7	530	170	70	20	7.5
	3	440	130	50	13	4.5
	3.3	390	110	37	9	3
	3.6	300	80	27	6	2.2
4 hrs/ day	2.4	480	240	110	28	—
	2.7	450	215	90	22	—
	3	410	190	75	18.5	—
	3.3	330	150	55	14	—
	3.6	265	100	40	7	—

VS067

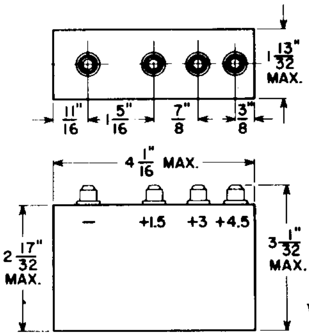
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	2.4	1200	350	84	33	18
	2.7	1050	275	70	26	14
	3	940	250	55	20	11
	3.3	880	220	40	13	6.5
	3.6	620	155	25	8	4
4 hrs/ day	2.4	940	320	90	35	19
	2.7	880	275	75	28	15
	3	840	260	56	22	12
	3.3	760	235	44	16	8.5
	3.6	680	180	36	12	4

VS072

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	20 ma.	50 ma.	100 ma.	300 ma.
Contin-uous	2.4	600	285	100	43	8.5
	2.7	540	252	84	35	6.5
	3	495	223	72	29	5
	3.3	425	200	63	25	3.6
	3.6	380	165	49	18	1.7
4 hrs/ day	2.4	580	300	115	48	9
	2.7	560	285	97	41	7
	3	530	260	86	34	5
	3.3	495	235	72	29	3.6
	3.6	385	205	57	20	1.7

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
4.5-VOLT BATTERIES								
VS130	0-150	11.5 oz.	Leclanché	D	3	Series	Screw (8-32 Thread) and Knurled Nut	Voltage taps at +1.5, +3, +4.5 volts with a common negative terminal —For portable "C" service
VS133	0-50	3.5 oz.	Leclanché	B	3	Series	Flat-Spring	For industrial "A" and miscellaneous applications
VS142	0-25	2.2 oz.	Leclanché	AA	3	Series	Flat-Spring	For flat flashlights
VS321	0-200	2 lbs 5 oz.	Leclanché	*	6	Series-Parallel	Plug-In Socket (ASA No. III)	For table-model transistor radios
VS324	0-40	4.5 oz.	Leclanché	*	6	Series-Parallel	Snap-Fastener (ASA No. XVII)	For transistor radios
VS1149	0-100	1.1 oz.	Alkaline	*	3	Series	Flashlight Type	For transistor radios

DIMENSIONAL OUTLINES



VS130

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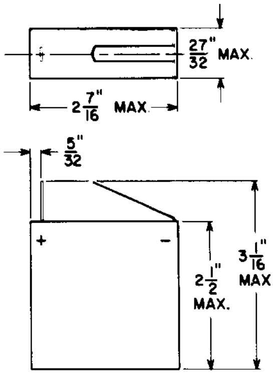

VS133

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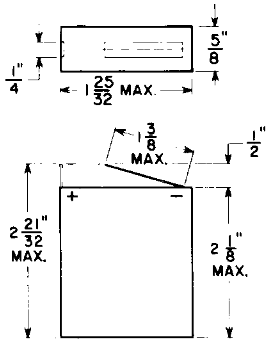

VS142

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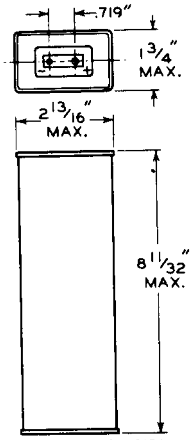
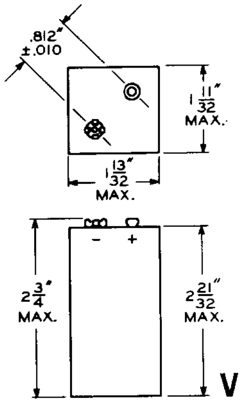


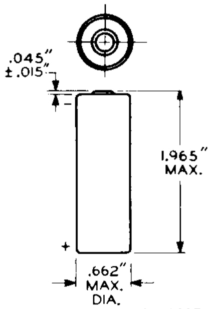
92CS-10151

VS321



VS324

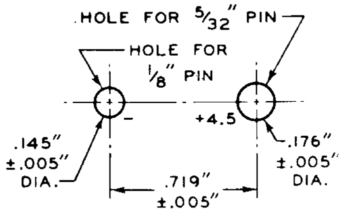
92CS-10148



92CS-10097

VS1149

SOCKET PATTERN



VS321

*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS130

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	50 ma.	100 ma.	300 ma.
Contin-uous	2.4	1050	200	92	32	6
	2.7	745	145	67	24	4.5
	3	600	115	52	19	3.5
	3.3	500	88	40	14	3
	3.6	370	65	29	9.5	2
4 hrs/ day	2.4	660	220	123	50	8
	2.7	620	200	108	41	6
	3	580	185	96	36	3.5
	3.3	530	155	81	30	3
	3.6	470	125	64	22	2

VS133

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	50 ma.	100 ma.
Contin-uous	2.4	610	205	87	26	10
	2.7	530	170	70	20	7.5
	3	440	130	50	13	4.5
	3.3	390	110	37	9	3
	3.6	300	80	27	6	2.2
2 hrs/ day	2.4	420	220	110	37	15
	2.7	380	190	90	30	12
	3	340	155	75	24	9
	3.3	290	130	57	18	6.2
	3.6	250	107	45	14	4.5

VS142

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	10 ma.	20 ma.	50 ma.
Contin-uous	2.4	1440	220	94	37	10
	2.7	1250	200	80	30	8.5
	3	1180	160	66	25	7
	3.3	1040	130	52	19	4.8
	3.6	700	90	35	11	2.8
2 hrs/ day	2.4	—	265	125	54	14
	2.7	—	255	120	50	12
	3	—	240	110	46	10
	3.3	—	210	92	36	8
	3.6	—	145	60	22	3.8

VS321

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		30 ma.	50 ma.	100 ma.		
Contin-uous	2.4	1200	—	—		
	2.7	1140	—	—		
	3	1050	—	—		
	3.3	750	—	—		
	3.6	575	—	—		
4 hrs/ day	2.4	1325	700	—		
	2.7	1250	625	—		
	3	1150	500	—		
	3.3	775	375	—		
	3.6	600	350	—		
2 hrs/ day	2.4	1250	—	375	—	—

VS324

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			20 ma.			
2 hrs/ day	2.4	225	130			
	3	225	100			

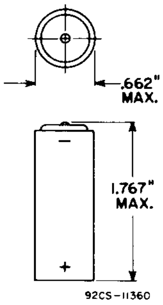
VS1149

Duty Cycle	End-point Volts	Average Service Hours At 3.75 Volts And Indicated Initial Current Drains				
		5 ma.	10 ma.	15 ma.	25 ma.	
Contin-uous	3.7	148	73	44	21	
	3.8	132	61	36	18	
	3.9	112	48	29	15	
	4	83	35	21	12	
	4.1	42	21	12	8	

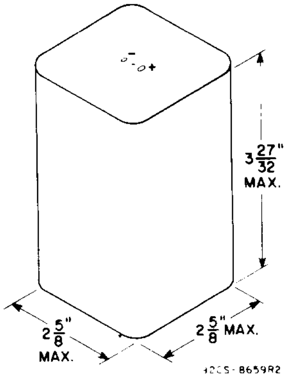
TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
5.6-VOLT BATTERY								
VS164	0–50	1.16 oz.	Mercury	M30	4	Series	Flashlight Type	For transistor service
6-VOLT BATTERIES								
VS009	0–250	1 lb 6 oz.	Leclanché	F	4	Series	Plug-In Socket (ASA No. IV)	Portable "A"
VS039	0–1500	9 lbs 4 oz.	Leclanché	6	4	Series	Screw (8-32 Thread) and Knurled Nut	For ignition service and lighting
VS040C	0–250	1 lb 5.5 oz.	Leclanché	F	4	Series	Spiral-Spring	For lantern service

6-volt types continued on pages 36 and 37.

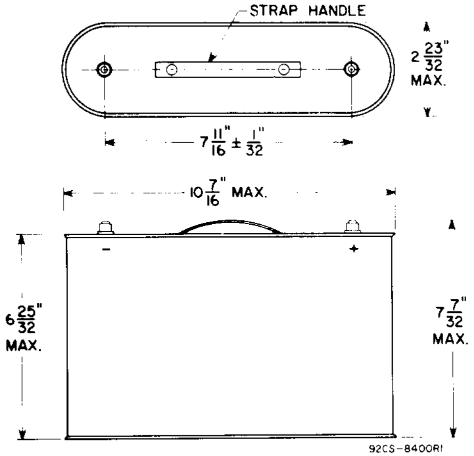
DIMENSIONAL OUTLINES



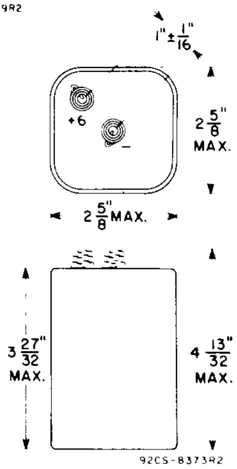
VS164



VS009

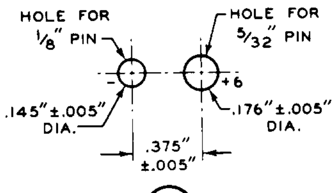


VS069



VS040C

SOCKET PATTERN



VS009

HOURS OF SERVICE

at 70°F

VS164

Duty Cycle	End-point Volts	Average Service Hours At 5 Volts And Indicated Initial Current Drains				
		15.5 ma.	25 ma.	50 ma.		
Contin-uous	3.6	33	20	8.5		
	4	32	18	6		
	4.4	30	15	2.8		
	4.8	10	5	0.6		
	5.2	2		—		

VS009

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	3.2	1200	350	84	33	18
	3.6	1050	275	70	26	14
	4	940	250	55	20	10
	4.4	880	220	40	13	6.5
	4.8	620	155	25	8	4
4 hrs/ day	3.2	940	320	90	35	19
	3.6	880	275	75	28	15
	4	840	260	56	22	12
	4.4	760	235	44	16	8.5
	4.8	680	180	36	12	4

VS039

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			562 ma.			
See Footnote	3.4	10.67	80			

Heavy Intermittent Test — Two discharge periods daily according to the following schedule:

1 hour discharge — 6 hours rest
1 hour discharge — 16 hours rest

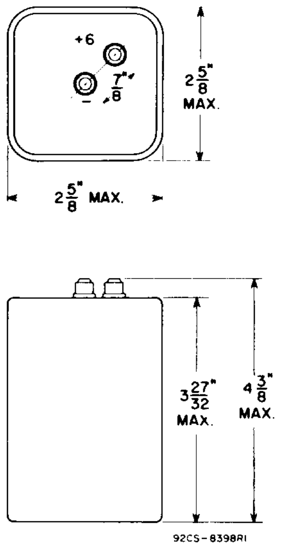
VS040C

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			60 ma.	187 ma.	375 ma.	667 ma.
4 hrs/ day	3.6	100	180			
	4	100	145			
	4.4	100	105			
See Footnote	2.3	9				9
	3.6	9				5
	3.6	16			13	
	3.6	32		37		

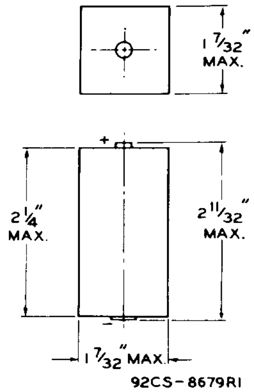
Test conducted for 8 consecutive hours consisting of 8 discharge periods for a duration of 30 minutes for each period at intervals of one hour.

TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
6-VOLT BATTERIES								
VS040S	0-250	1 lb 7 oz.	Leclanché	F	4	Series	Screw (8-32 Thread)	For lighting and miscellaneous applications
VS068	0-25	2.5 oz.	Leclanché	AA	4	Series	Flashlight Type	Portable "A"
VS103	0-1000	5 lbs 11 oz.	Leclanché	F	16	Series-Parallel	Screw (8-32 Thread) and Knurled Nut	For emergency lighting
VS317	0-500	3 lbs 4 oz.	Leclanché	F	8	Series-Parallel	Screw (8-32 Thread) and Knurled Nut	For industrial and lantern service
VS325	0-25	4 oz.	Leclanché	*	4	Series	Snap-Fastener (ASA No. XVII)	For portable transistor radios

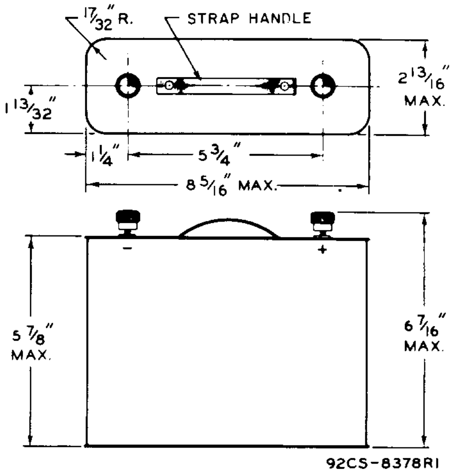
DIMENSIONAL OUTLINES



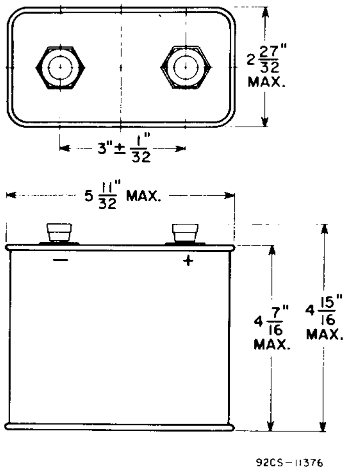
VS040S



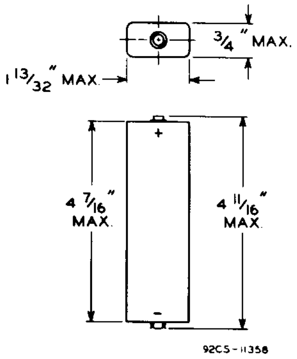
VS068



VS103



VS317



VS325

**No comparable ASA number.*

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS040S

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			60 ma.			
4 hrs/ day	3.6	100	180			
	4	100	145			
	4.4	100	105			

VS068

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	30 ma.	100 ma.
Contin-uous	3.2	270	117	49	28	5
	3.6	255	110	45	26	4.5
	4	230	98	40	23	4
	4.4	210	88	34	19	3
	4.8	185	74	28	16	2.3
2 hrs/ day	3.2	290	145	72	45	8.5
	3.6	285	140	68	43	7
	4	275	135	64	39	6
	4.4	270	130	60	35	4
	4.8	250	115	49	27	2.5

VS103

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		40 ma.	120 ma.	400 ma.	800 ma.	1200 ma.
Contin-uous	3.2	1200	350	84	33	18
	3.6	1050	275	70	26	14
	4	940	250	55	20	11
	4.4	880	220	40	13	6.5
	4.8	620	155	25	8	4
4 hrs/ day	3.2	940	320	90	35	19
	3.6	880	275	75	28	15
	4	840	260	56	22	12.5
	4.4	760	235	44	16	8.5
	4.8	680	180	36	12	4

VS317

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			667 ma.			
Contin-uous	3.2	9	15			
	3.6	9	12			
	4	9	10			
6 hrs/ day	3.2	9	17			
	3.6	9	15			
	4	9	11			
See Footnote	3.2	9	22			
	3.6	9	19			
	4	9	15			

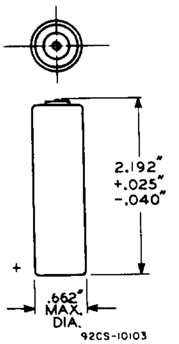
Test conducted for 8 consecutive hours consisting of 8 discharge periods for a duration of 30 minutes for each period at intervals of one hour.

VS325

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		12 ma.	16 ma.	40 ma.	75 ma.	
2 hrs/ day	3.6	157	122	41	19	
	4	152	119	38	16	
	4.4	146	112	31	13	
	4.8	139	107	23	8.5	
	5.2	69	52	8.5	2.9	

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
7-VOLT BATTERY								
VS165	0–50	1.45 oz.	Mercury	M30	5	Series	Flashlight Type	For remote tuning-control service
7.5-VOLT BATTERIES								
VS029	0–50	7.5 oz.	Leclanché	B	5	Series	Screw (8-32 Thread) and Knurled Nut	Voltage taps at −1.5, −3, −4.5, −6, −7.5 volts with a common positive terminal— Portable "C"
VS065	0–70	8 oz.	Leclanché	*	5	Series	Plug-In Socket (ASA No. V)	Portable "A"
VS129	0–50	6.3 oz.	Leclanché	B	5	Series	Plug-In Socket (ASA No. V)	Portable "A"
VS139	0–1000	7 lbs 10 oz.	Leclanché	F	20	Series-Parallel	Screw (8-32 Thread) and Knurled Nut	For ignition service and emergency lighting
VS315	0–80	12 oz.	Leclanché	F100	5	Series	Snap-Fastener (ASA No. XV)	Portable "A"

DIMENSIONAL OUTLINES



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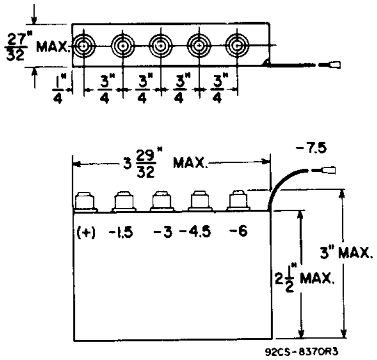

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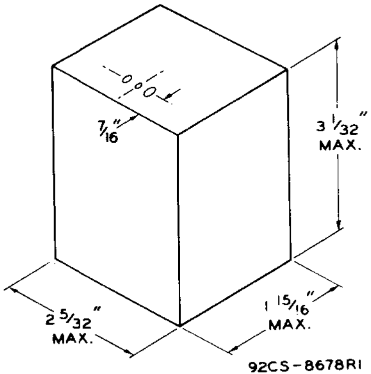

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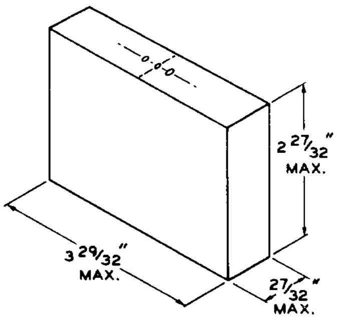

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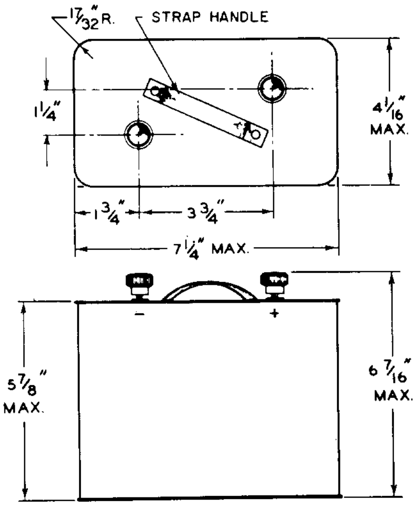

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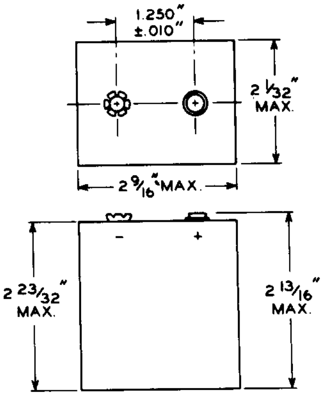
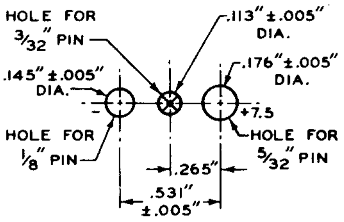


VS315

SOCKET PATTERN



VS065 VS129

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*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS165

Duty Cycle	End-point Volts	Average Service Hours At 6.25 Volts And Indicated Initial Current Drains				
		15.5 ma.	25 ma.	50 ma.		
Contin-uous	4.5	33	20	8		
	5	32.5	19	6.2		
	5.5	31	15	2.5		
	6	8	4	0.5		
	6.5	1.2	—	—		

VS029

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	50 ma.	100 ma.
Contin-uous	4	610	205	87	26	10
	4.5	530	170	70	20	7.5
	5	440	130	50	13	4.5
	5.5	390	110	37	9	3
	6	300	80	27	6	2.2
4 hrs/ day	4	480	240	110	28	—
	4.5	450	215	90	22	—
	5	410	190	75	19	—
	5.5	330	150	55	14	—
	6	265	100	40	7	—

VS065

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	10 ma.	20 ma.	40 ma.	80 ma.
Contin-uous	4	2075	490	195	75	25
	4.5	1950	430	165	60	20
	5	1800	380	140	48	15
	5.5	1600	300	104	33	10
	6	1150	210	72	24	6
4 hrs/ day	4	1925	580	270	120	40
	4.5	1800	520	240	100	35
	5	1650	450	200	80	25
	5.5	1325	340	150	60	20
	6	1050	255	105	26	8

VS129

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			60 ma.			
2 hrs/ day	4.5	125	22.5			
	5	125	21			
	5.5	125	17			

VS139

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		40 ma.	120 ma.	400 ma.	800 ma.	1200 ma.
Contin-uous	4	1200	350	84	33	18
	4.5	1050	275	70	26	14
	5	940	250	55	20	11
	5.5	880	220	40	13	6.5
	6	620	155	25	8	4
4 hrs/ day	4	940	320	90	35	19
	4.5	880	275	75	28	15
	5	840	260	56	22	12
	5.5	760	235	44	16	8.5
	6	680	180	36	12	4

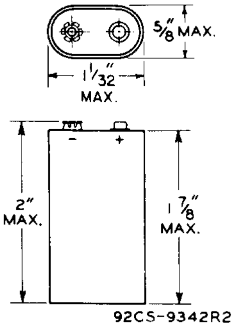
VS315

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	30 ma.	50 ma.
Contin-uous	4	1600	700	280	170	90
	5	1350	540	210	125	65
	5.5	1000	380	140	80	40
2 hrs/ day	4	920	540	300	200	110
	4.5	860	480	275	170	95
	5	800	440	245	150	80
	5.5	715	380	200	130	60
	6	600	300	140	85	38

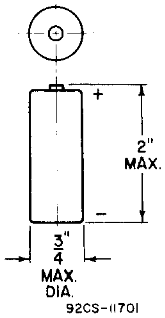
RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
8.4-VOLT BATTERIES								
VS312	0–30	1.6 oz.	Mercury	M25	6	Series	Snap-Fastener*	For transistor radios
VS328	0–50	1.65 oz.	Mercury	*	6	Series	Flashlight Type	For transistor radios
9-VOLT BATTERIES								
VS140	0–1000	8 lbs 8 oz.	Leclanché	F	24	Series-Parallel	Screw (8-32 Thread) and Knurled Nut	For emergency lighting
VS300A	0–9	2 oz.	Leclanché	*	6	Series	Snap-Fastener (ASA No. XV)	For transistor service
VS301	0–150	1 lb 8 oz.	Leclanché	D	6	Series	Plug-In Socket*	Voltage taps at +3, +6, and +9 volts with a common negative terminal — For transistor service

DIMENSIONAL OUTLINES

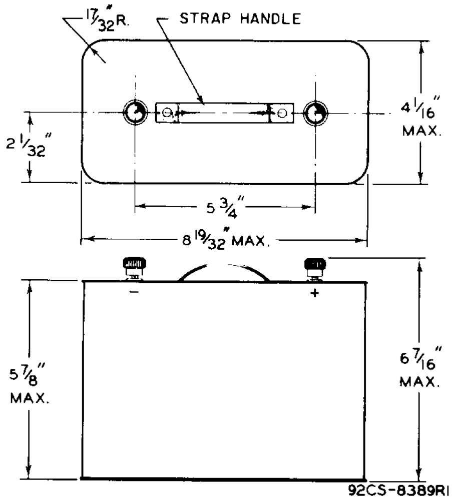
9-volt types continued on pages 42 and 43.



VS312



VS328



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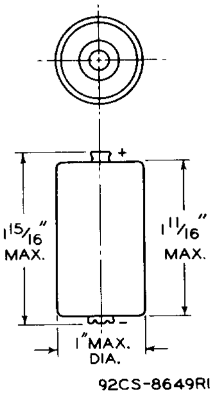
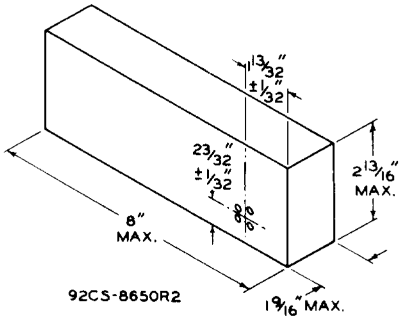
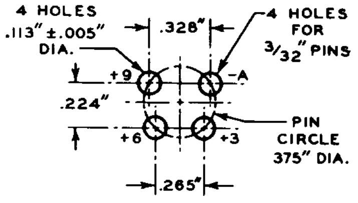


VS300A



VS301

SOCKET PATTERN



VS301

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*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS312

Duty Cycle	End-Point Volts	Average Service Hours At 7.5 Volts And Indicated Initial Current Drains				
		1.5 ma.	3 ma.	5 ma.	10 ma.	
Contin-uous	5.4	230	115	70	35	
	6	229	114	65	30	
	6.5	228	112	59	26	
	7	225	110	52	18	
	7.5	215	90	25	5	

320 mA-HR

VS328

Duty Cycle	End-Point Volts	Average Service Hours At 7.5 Volts And Indicated Initial Current Drains				
		5 ma.	10 ma.	15 ma.	20 ma.	25 ma.
Contin-uous	5.4	135	66	44	32	23
	6	134	62	39	26	16
	6.6	131	54	25	10	5
	7.2	125	24	5	1.5	0.2
	7.8	60	7	0.5	—	—

VS140

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		40 ma.	120 ma.	400 ma.	800 ma.	1200 ma.
Contin-uous	4.8	1200	350	84	33	18
	5.4	1050	275	70	26	14
	6	940	250	55	20	11
	6.6	880	220	40	13	6.5
	7.2	620	155	25	8	4
4 hrs/ day	4.8	940	320	90	35	19
	5.4	880	275	75	28	15
	6	840	260	56	22	12
	6.6	760	235	44	16	8.5
	7.2	680	180	36	12	4

VS300A

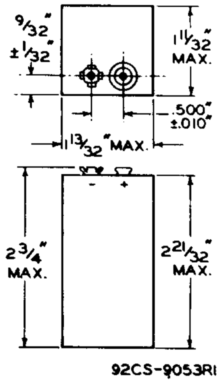
Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			5 ma.	7 ma.	11.5 ma.	16 ma.
2 hrs/ day	4.8	1800	150	—	—	—
	4.8	1300	—	117	—	—
	4.8	780	—	—	68	—
	4.8	560	—	—	—	44
	6	1800	130	—	—	—
	6	1300	—	98	—	—
	6	780	—	—	57	—
	6	560	—	—	—	33

VS301

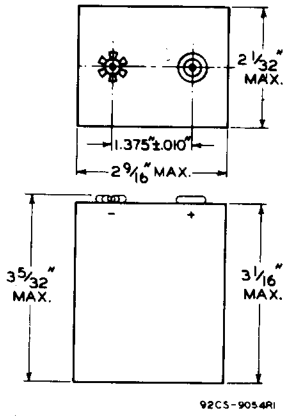
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	20 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	4.8	1050	360	32	12	6
	5.4	745	260	24	8.5	4.5
	6	600	210	19	6.5	3.5
	6.6	500	165	14	4.5	3
	7.2	370	125	9.5	3.2	2
4 hrs/ day	4.8	660	330	50	18	8
	5.4	620	310	41	14	6
	6	580	290	36	12	3.5
	6.6	530	260	30	9	3
	7.2	470	230	22	5.2	2

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
9-VOLT BATTERIES								
VS305	0-15	4.5 oz.	Leclanché	*	12	Series-Parallel	Snap-Fastener (ASA No. XVII)	For transistor service
VS306	0-30	15 oz.	Leclanché	F100	6	Series	Snap-Fastener (ASA No. XV)	For transistor service
VS322	0-20	7 oz.	Leclanché	F90	6	Series	Snap-Fastener (ASA No. XV)	For transistor service
VS323	0-8	1.5 oz.	Leclanché	*	6	Series	Snap-Fastener (ASA No. XVII)	For transistor service
VS326	0-20	4 oz.	Leclanché	*	6	Series	Snap-Fastener (ASA No. XV)	For transistor service
VS327	0-7	1.2 oz.	Leclanché	*	6	Series	Flashlight Type Negative Terminal Recessed	For portable pocket-transistor radios

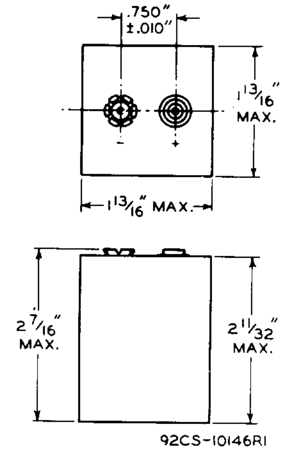
DIMENSIONAL OUTLINES



VS305



VS306



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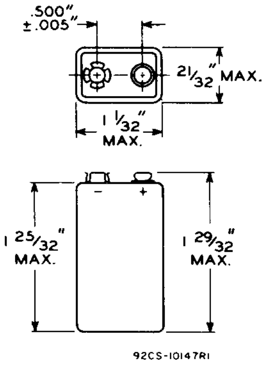

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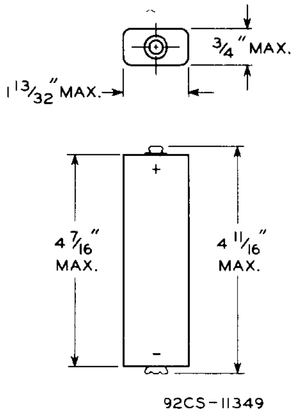

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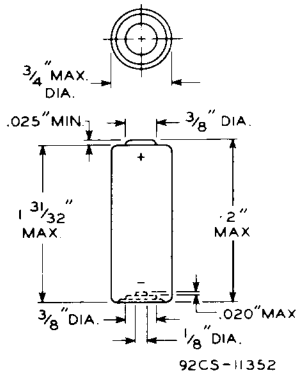


VS327

*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS305

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		2 ma.	6 ma.	10 ma.	20 ma.	40 ma.
Contin-uous	4.8	1420	350	165	62	23
	5.4	1260	305	145	52	19
	6	1100	255	120	42	15
	6.6	910	215	100	34	11
	7.2	665	160	75	25	7
4 hrs/ day	4.8	1005	410	255	100	34
	5.4	980	380	220	85	28
	6	925	350	195	72	23
	6.6	805	310	165	58	17
	7.2	640	210	110	35	9

VS306

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	30 ma.	50 ma.
Contin-uous	4.8	1600	700	280	170	90
	6	1350	540	210	125	65
	6.6	1000	380	140	80	40
2 hrs/ day	4.8	920	540	300	200	110
	5.4	860	480	275	170	95
	6	800	440	245	150	80
	6.6	715	380	200	130	60
	7.2	600	300	140	85	38

VS322

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.5 ma.	5 ma.	10 ma.	20 ma.	80 ma.
Contin-uous	4.8	6000	640	275	105	12
	5.4	5600	590	250	92	9
	6	5200	500	205	74	7
	6.6	4800	375	138	44	3.3
	7.2	4200	230	78	23	1.3
4 hrs/ day	4.8	2400	520	295	138	15
	5.4	2200	470	265	120	12
	6	1950	395	220	96	8
	6.6	1700	320	170	70	3.3
	7.2	1400	240	125	45	1.3

VS323

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		4 ma.	6 ma.	10 ma.	15 ma.	25 ma.
2 hrs/ day	4.8	87	63	40	27	15
	5.4	83	60	38	25	12
	6	78	53	32	20	9
	6.6	68	46	27	15	6
	7.2	49	32	17	9	2

312 mA-HR

VS326

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	12 ma.	40 ma.	60 ma.	
2 hrs/ day	5.4	207	89	23	12	
	6	197	86	20	10	
	6.6	187	83	16	8.5	
	7.2	161	76	11	4.7	
	7.8	96	34	2.4	1	

VS327

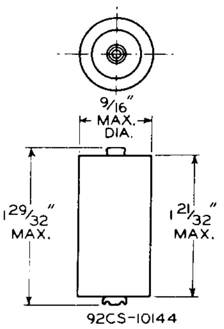
Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			5 ma.	12 ma.	25.7 ma.	
2 hrs/ day	3.6	1800	95	—	—	
	3.6	750	—	30	—	
	3.6	350	—	—	15	
	4.8	1800	93	—	—	
	4.8	750	—	26	—	
	4.8	350	—	—	10	
	6	1800	80	—	—	
	6	750	—	20	—	
	6	350	—	—	5	
4 hrs/ day	3.6	750	—	34	—	
	4.8	750	—	26	—	

9.8-Volt Type
12-Volt Type
13.5-Volt Type
15-Volt Types

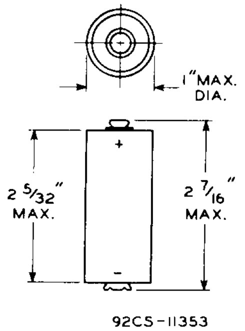
RCA BATTERIES

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
9.8-VOLT BATTERY								
VS309A	0–10	0.67 oz.	Mercury	M15	7	Series	Snap-Fastener (ASA No. XVII)	For transistor radios
12-VOLT BATTERY								
VS329	0–9	2.3 oz.	Leclanché	*	8	Series	Snap-Fastener (ASA No. XV)	For Citizens-Band radios
13.5-VOLT BATTERY								
VS304	0–10	3 oz.	Leclanché	F40	9	Series	Plug-In Socket*	Voltage taps at +9, and +13.5 volts with a common negative terminal — For transistor service
15-VOLT BATTERIES								
VS083	0–2.5	0.8 oz.	Leclanché	F20	10	Series	Flat-Contact	For paging devices and pocket receivers
VS704	0–1.5	0.6 oz.	Leclanché	F15	10	Series	Flat-Projecting (one each end)	For photoflash service, radio paging and pocket receivers

DIMENSIONAL OUTLINES



VS309A



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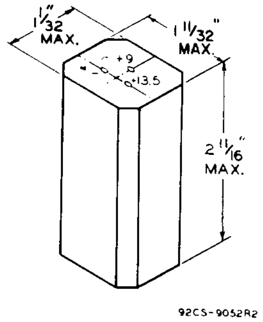
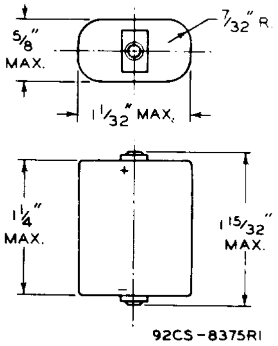
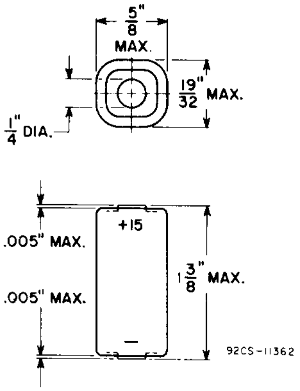


VS304

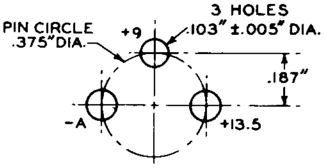


VS083



VS704

SOCKET PATTERN



VS304

*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS309A

Duty Cycle	End-Point Volts	Average Service Hours At 8.75 Volts And Indicated Initial Current Drains				
		1 ma.	2 ma.	3 ma.	5 ma.	
Contin-uous	6.4	160	80	52	32	
	7	158	75	48	31.5	
	7.5	154	70	43	30	
	8	145	65	32	25	
	8.5	135	55	20	15	

VS329

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	7 ma.	11.5 ma.	16 ma.	
2 hrs/ day	6.4	150	—	—	—	
	6.4	—	117	—	—	
	6.4	—	—	68	—	
	6.4	—	—	—	44	
	8	130	—	—	—	
	8	—	98	—	—	
	8	—	—	57	—	
	8	—	—	—	33	

VS304

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.5 ma.	1 ma.	10 ma.	20 ma.	35 ma.
Contin-uous	7.2	1700	820	40	14	6
	8.1	1620	740	33	12	5
	9	1550	650	27	9.5	3.8
	9.9	1300	530	19	6.5	2.4
	10.8	1000	390	10.5	4	0.8
2 hrs/ day	7.2	920	630	63	20	7
	8.1	890	590	56	18	6.2
	9	850	550	47	15	5.4
	9.9	810	480	35	11	2.7
	10.8	730	410	21	5.4	0.8

VS083

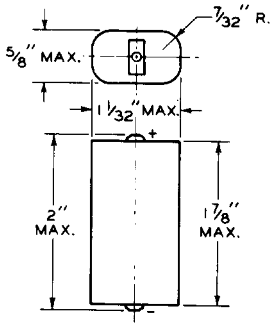
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.2 ma.	0.5 ma.	1 ma.	2 ma.	5 ma.
12 hrs/ day	8	810	320	140	62	20
	9	780	295	130	53	16
	10	740	275	117	45	10
	11	705	255	105	40	9
	12	645	220	88	32	4
2 hrs/ day	8	770	320	150	74	24
	9	730	310	144	68	21
	10	700	295	138	64	18
	11	660	275	130	59	15
	12	610	250	115	50	5

VS704

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.05 ma.	0.1 ma.	0.5 ma.	1 ma.	5 ma.
Contin-uous	8	2050	1000	155	61	4.4
	9	1900	920	140	53	3.5
	10	1750	860	125	47	3
	11	1500	740	107	38	1.9
	12	1190	580	74	21	0.28
2 hrs/ day	8	1400	780	182	82	6.2
	9	1310	740	165	74	5.6
	10	1230	670	150	66	4.2
	11	1150	620	130	55	2.9
	12	1030	560	105	34	0.4

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
22.5-VOLT BATTERIES								
VS084	0–2.5	1.2 oz.	Leclanché	F20	15	Series	Flat-Contact	For paging devices and pocket receivers
VS102	0–40	13.5 oz.	Leclanché	F80	15	Series	Screw (8-32 Thread) and Knurled Nut	For portable "B" or "C" circuit applications
VS131	0–50	1 lb 4 oz.	Leclanché	B	15	Series	Spring-Clip (Fahnestock)	Voltage taps at −3, −4.5, −6, −9, −10.5, −16.5, and −22.5 volts with a common positive terminal— Portable "C" applications
VS705	0–1.5	0.8 oz.	Leclanché	F15	15	Series	Flat-Recessed (one each end)	For photoflash service, radio paging and pocket receivers
30-VOLT BATTERY								
VS085	0–2.5	1.4 oz.	Leclanché	F20	20	Series	Flat-Contact	For paging devices and pocket receivers

DIMENSIONAL OUTLINES



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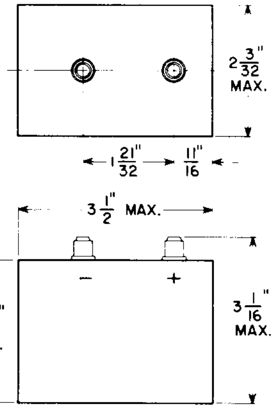
VS084



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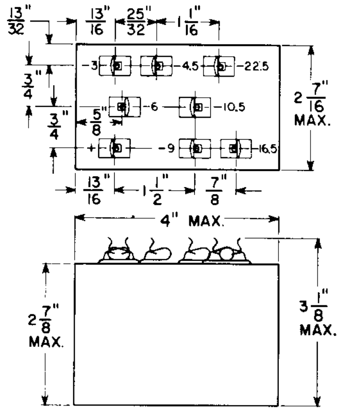
VS102



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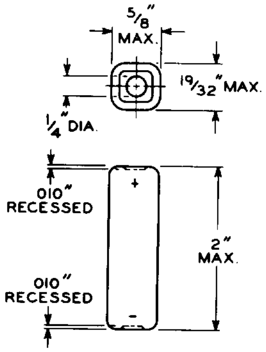
VS131



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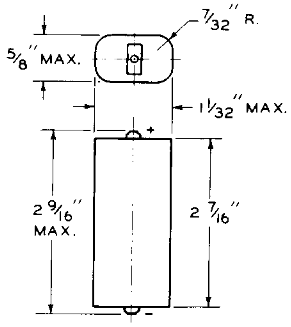
VS705



92CS-8192R1

VS085

HOURS OF SERVICE

at 70°F

VS084

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.2 ma.	0.5 ma.	1 ma.	2 ma.	5 ma.
12 hrs/ day	12	810	320	140	62	20
	13.5	780	295	130	53	16
	15	740	275	117	45	10
	16.5	705	255	105	40	9
	18	645	220	88	32	4
2 hrs/ day	12	770	320	150	74	24
	13.5	730	310	144	68	21
	15	700	295	138	64	18
	16.5	660	275	130	59	15
	18	610	250	115	50	5

VS102

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			4.5 ma.	9 ma.	18 ma.	
Contin-uous	15	5000	385	—	—	
4 hrs/ day	15	5000	525	—	—	
	15	2500	—	225	—	
	15	1250	—	—	85	

VS131

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	50 ma.	100 ma.
Contin-uous	12	610	205	87	26	10
	13.5	530	170	70	20	7.5
	15	440	130	50	13	4.5
	16.5	390	110	37	9	3
	18	300	80	27	6	2.2
2 hrs/ day	12	420	220	110	37	15
	13.5	380	190	90	30	12
	15	340	155	75	24	9
	16.5	290	130	57	18	6
	18	250	107	45	14	4.5

VS705

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.05 ma.	0.1 ma.	0.5 ma.	1 ma.	5 ma.
Contin-uous	12	2050	1000	155	61	4.4
	13.5	1900	920	140	53	3.5
	15	1750	860	125	47	3
	16.5	1500	740	107	38	1.9
	18	1190	580	74	21	0.28
2 hrs/ day	12	1400	780	182	82	6.2
	13.5	1310	740	165	74	5.6
	15	1230	670	150	66	4.2
	16.5	1150	620	130	55	2.9
	18	1030	560	105	34	0.4

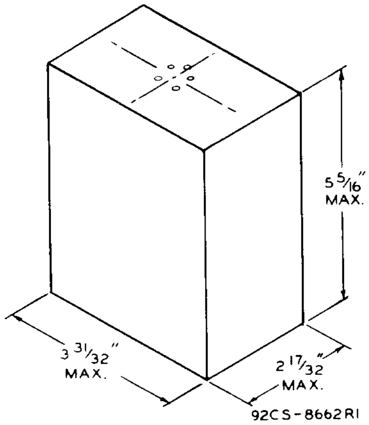
VS085

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.2 ma.	0.5 ma.	1 ma.	2 ma.	5 ma.
12 hrs/ day	16	810	320	140	62	20
	18	780	295	130	53	16
	20	740	275	117	45	10
	22	705	255	105	40	9
	24	645	220	88	32	4
2 hrs/ day	16	770	320	150	74	24
	18	730	310	144	68	21
	20	700	295	138	64	18
	22	660	275	130	59	15
	24	610	250	115	50	5

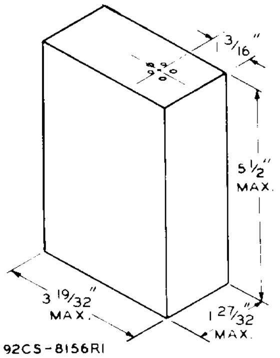
RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
45-VOLT BATTERIES								
VS012	0-70	3 lbs 2 oz.	Leclanché	*	30	Series	Plug-In Socket (ASA No. IX)	Portable "B"
VS013	0-40	1 lb 15 oz.	Leclanché	F90	30	Series	Plug-In Socket (ASA No. IX)	Portable "B"
VS014	0-40	1 lb 11.8 oz.	Leclanché	F80	30	Series	Plug-In Socket (ASA No. IX)	Portable "B"
VS015	0-25	1 lb 3 oz.	Leclanché	AA	30	Series	Plug-In Socket (ASA No. X)	Voltage taps at +22.5 and +45 volts with a common negative terminal
VS055	0-10	7.8 oz.	Leclanché	F40	30	Series	Snap-Fastener (ASA No. XV)	Portable "B"

45-volt types continued on pages 50 and 51.

DIMENSIONAL OUTLINES



VS012



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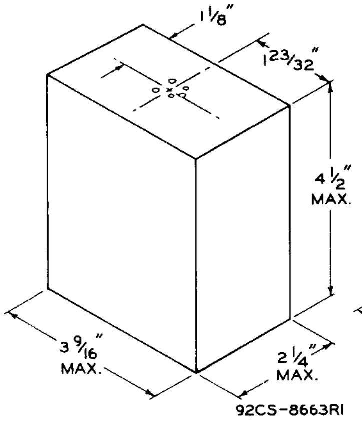

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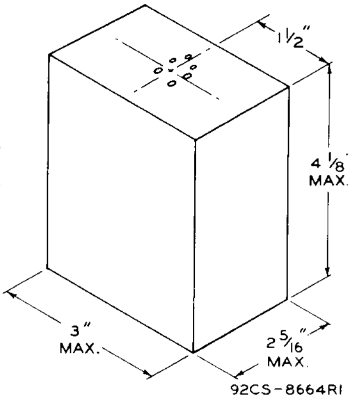

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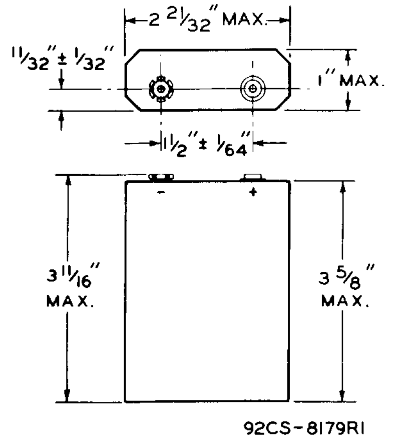
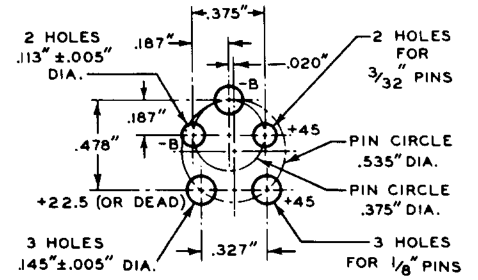
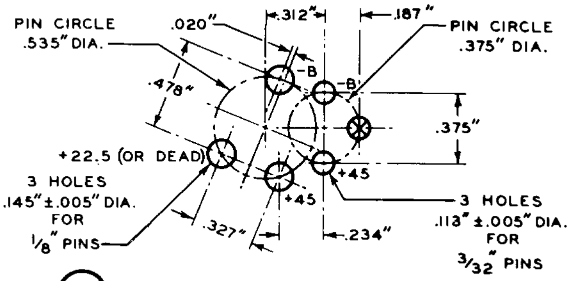


VS055

SOCKET PATTERNS



VS012
VS013
VS014



VS015

*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS012

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	10 ma.	20 ma.	40 ma.	80 ma.
Contin-uous	24	2075	490	195	75	25
	27	1950	430	165	60	20
	30	1800	380	140	48	15
	33	1600	300	104	33	10
	36	1150	210	72	24	6
4 hrs/ day	24	1925	580	270	120	40
	27	1800	520	240	100	35
	30	1650	450	200	80	25
	33	1325	340	150	60	20
	36	1050	255	105	26	8

VS013

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	20 ma.	40 ma.	80 ma.
Contin-uous	24	3350	640	105	37	12
	27	3100	590	92	30	9
	30	2900	500	74	23	7
	33	2575	375	44	12	3.3
	36	2100	230	23	5.7	1.3
4 hrs/ day	24	1650	520	138	50	15
	27	1500	470	120	43	12
	30	1300	395	96	32	8
	33	1140	320	70	22	3.3
	36	920	240	45	9.5	1.3

VS014

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		4.5 ma.	9 ma.	18 ma.		
Contin-uous	30	385	—	—		
4 hrs/ day	30	505	—	—		
	30	—	225	—		
	30	—	—	85		

VS015

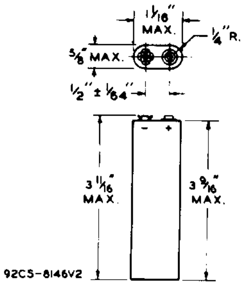
Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			4.5 ma.	9 ma.	18 ma.	
Contin-uous	30	10,000	225	—	—	
4 hrs/ day	30	10,000	256	—	—	
	30	5000	—	120	—	
	30	2500	—	—	45	

VS055

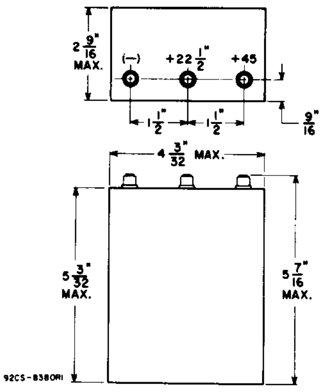
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	10 ma.	20 ma.	35 ma.
Contin-uous	24	820	105	40	14	6
	27	740	90	33	12	5
	30	650	75	27	9.5	3.8
	33	530	55	19	6.5	2.4
	36	390	36	11	4	0.8
2 hrs/ day	24	630	150	63	20	7
	27	590	140	56	18	6
	30	550	130	47	15	5.4
	33	480	98	35	11	2.7
	36	410	70	21	5.4	0.8

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
45-VOLT BATTERIES								
VS086	0–4	2.5 oz.	Leclanché	F20	30	Series	Snap-Fastener*	Portable "B" and for use in pocket receivers
VS112	0–50	2 lbs 12 oz.	Leclanché	*	30	Series	Screw (8-32 Thread) and Knurled Nut	Voltage taps at +22.5 and +45 volts with a common negative terminal
VS114	0–20	14.5 oz.	Leclanché	*	30	Series	Screw (8-32 Thread) and Knurled Nut	Voltage taps at +22.5 and +45 volts with a common negative terminal—For industrial "B" and instrument applications
VS127W	0–250	10 lbs 5 oz.	Leclanché	F	30	Series	Spring-Clip (Fahnestock)	Voltage taps at +22.5 and +45 volts with a common negative terminal—For heavy duty "B" service
VS157W	0–300	11 lbs 14 oz.	Leclanché	G	30	Series	Spring-Clip (Fahnestock)	Voltage taps at +22.5 and +45 volts with a common negative terminal—For heavy duty "B" service

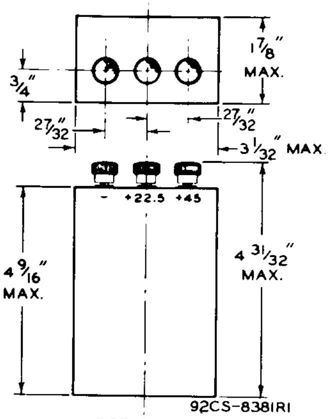
DIMENSIONAL OUTLINES



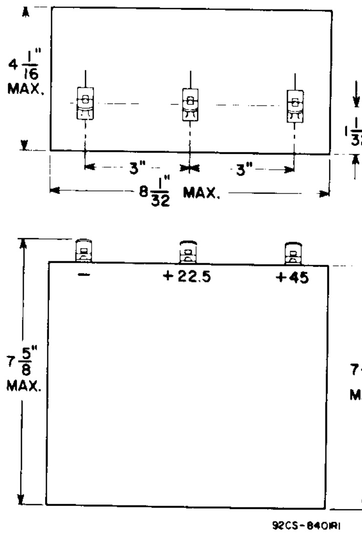
VS086



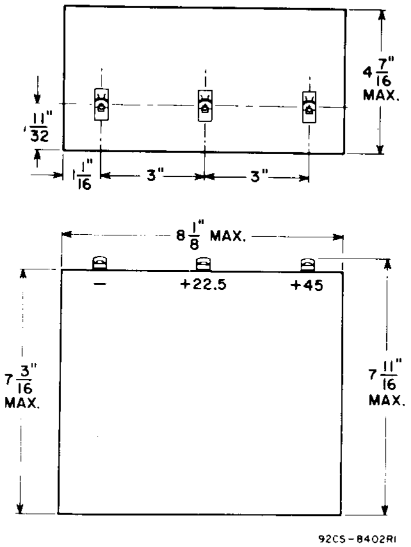
VS112



VS114



VS127W



VS157W

**No comparable ASA number.*

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS086

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.2 ma.	0.5 ma.	1 ma.	2 ma.	5 ma.
12 hrs/ day	24	810	320	140	62	20
	27	780	295	130	53	16
	30	740	275	117	45	10
	33	705	255	105	40	9
	36	645	220	88	32	4
2 hrs/ day	24	770	320	150	74	24
	27	730	310	144	68	21
	30	700	295	138	64	18
	33	660	275	130	59	15
	36	610	250	115	50	5

VS112

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	10 ma.	20 ma.	40 ma.	80 ma.
4 hrs/ day	24	1925	580	270	120	40
	27	1800	520	240	100	35
	30	1650	450	200	80	25
	33	1325	340	150	60	20
	36	1050	255	105	26	8

VS114

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	5 ma.	10 ma.	20 ma.	40 ma.
Contin-uous	24	385	181	68	26	9
	27	335	159	57	22	7
	30	280	132	46	17	5.5
	33	236	110	37	13	4
	36	176	82	27	8	2
4 hrs/ day	24	451	280	110	39	11
	27	418	242	93	32	9
	30	385	214	79	26	7
	33	341	181	64	20	3.9
	36	231	121	38	10	2

VS127W

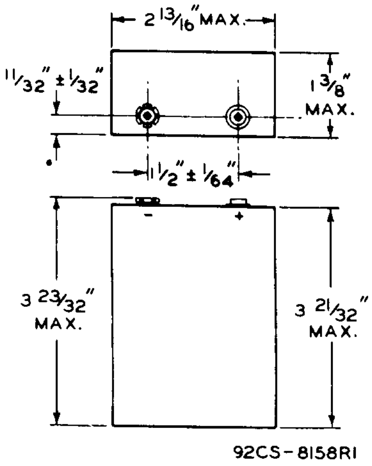
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	200 ma.	300 ma.
Contin-uous	24	1200	350	84	33	18
	27	1050	275	70	26	14
	30	940	250	55	20	10
	33	880	220	40	13	6.5
	36	620	155	25	8	4
4 hrs/ day	24	940	320	90	35	19
	27	880	275	75	28	15
	30	840	260	56	22	12
	33	760	235	44	16	8.5
	36	680	180	36	12	4

VS157W

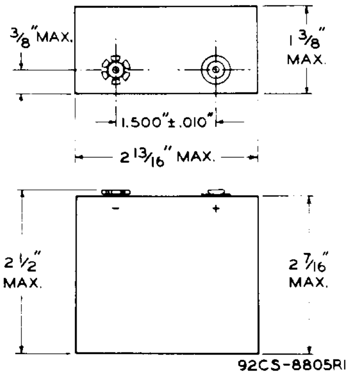
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	30 ma.	100 ma.	300 ma.	500 ma.
Contin-uous	24	1800	500	90	15	—
	27	1600	420	78	12	—
	30	1450	350	66	11	—
	33	1250	285	47	7	—
	36	1000	215	32	4.8	—
4 hrs/ day	24	1500	520	130	27	12
	27	1400	460	110	23	9.5
	30	1300	420	94	19	7
	33	1200	380	84	16	6
	36	1100	330	70	11	3

TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
67.5-VOLT BATTERIES								
VS016	0-10	12 oz.	Leclanché	F40	45	Series	Snap-Fastener (ASA No. XV)	Portable "B"
VS082	0-6	7.4 oz.	Leclanché	F30	45	Series	Snap-Fastener (ASA No. XV)	Portable "B"
VS218	0-8	8.6 oz.	Leclanché	*	44	Series	Snap-Fastener (ASA No. XV)	Portable "B"
VS318	0-3	4 oz.	Leclanché	*	46	Series	Snap-Fastener (ASA No. XVII)	Portable "B"

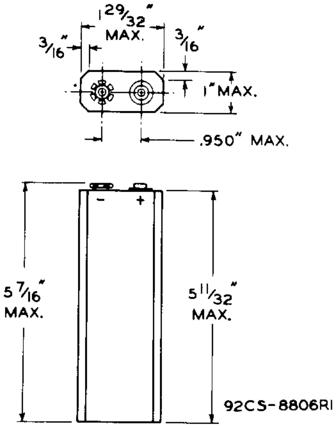
DIMENSIONAL OUTLINES



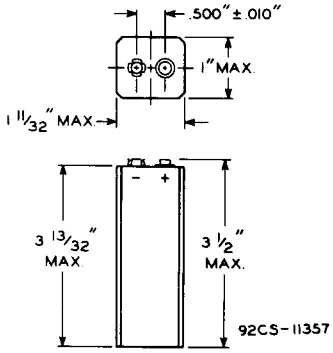
VS016



VS082



VS218



VS318

**No comparable ASA number.*

See page 62 for outlines and dimensions of snap-fastener terminals.

HOURS OF SERVICE

at 70°F

VS016

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.5 ma.	1 ma.	5 ma.	20 ma.	35 ma.
Contin-uous	36	1700	820	105	14	6
	40.5	1620	740	90	12	5
	45	1550	650	75	9.5	3.8
	49.5	1300	530	55	6.5	2.4
	54	1000	390	36	4	0.8
2 hrs/ day	36	920	630	150	20	7
	40.5	890	590	140	18	6.2
	45	850	550	130	15	5.4
	49.5	810	480	98	11	2.7
	54	730	410	70	5.4	0.8

VS082

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.5 ma.	1 ma.	5 ma.	10 ma.	20 ma.
Contin-uous	36	780	365	50	18	5.5
	40.5	700	330	40	13	4
	45	620	285	30	10	3
	49.5	540	230	22	6.5	2
	54	390	165	14	3.5	0.8
2 hrs/ day	36	720	380	60	25	7.5
	40.5	680	355	55	21	6
	45	630	330	48	16.5	4.5
	49.5	560	300	39	13	2
	54	460	225	28	7	0.8

VS218

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.6 ma.	1 ma.	2.5 ma.	5 ma.	10 ma.
Contin-uous	35.2	1070	640	215	80	27
	39.6	1000	580	180	64	19
	44	940	540	165	50	13
	48.4	880	500	145	43	10
	52.8	800	435	125	35	8
4 hrs/ day	35.2	860	560	225	105	43
	39.6	845	540	215	95	40
	44	820	520	200	90	36
	48.4	800	490	180	75	30
	52.8	780	450	150	60	22

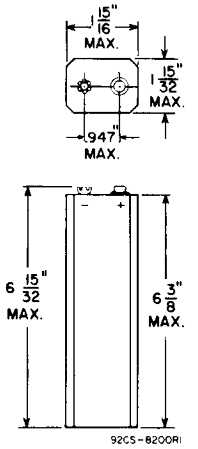
VS318

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			3.45 ma.			
2 hrs/ day	36	20,000	62			
	45	20,000	53			
	51	20,000	45			

75-Volt Type
90-Volt Types
300-Volt Type

RCA TYPE	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
				ASA Type	Units	Arrangement		
75-VOLT BATTERY								
VS217	0–10	14.8 oz.	Leclanché	F40	52	Series	Snap-Fastener (ASA No. XV)	Portable "B"
90-VOLT BATTERIES								
VS090	0–10	15 oz.	Leclanché	F40	60	Series	Snap-Fastener (ASA No. XV)	Portable "B"
VS219	0–8	12 oz.	Leclanché	*	60	Series	Snap-Fastener (ASA No. XV)	Portable "B"
VS316	0–10	1 lb	Leclanché	F40	60	Series	Snap-Fastener (ASA No. XV)	Portable "B"
300-VOLT BATTERY								
VS093	0–2.5	14.5 oz.	Leclanché	F20	200	Series	Plug-In Socket (Pin-Jack Type) (ASA No. XVIII)	For Geiger Counter service

DIMENSIONAL OUTLINES



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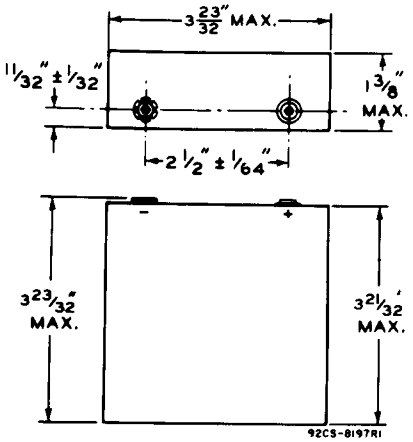
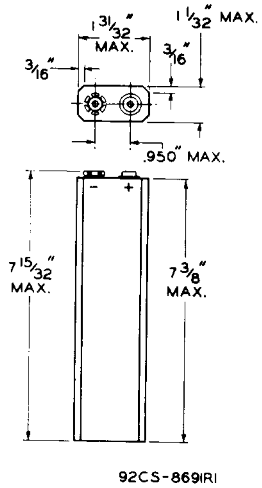


VS090



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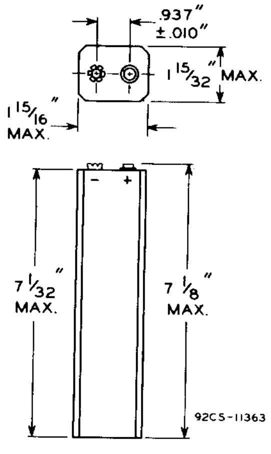
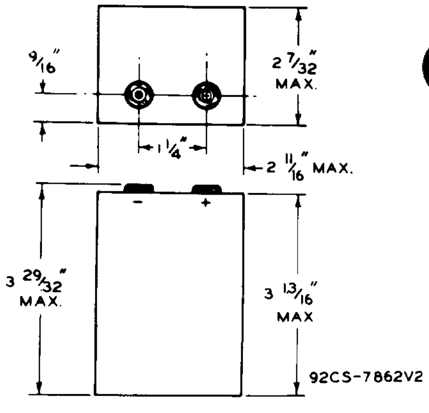


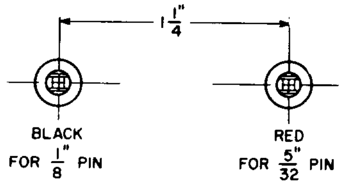
VS316



VS093

SOCKET PATTERN

ASA No. XVIII



VS093

*No comparable ASA number.

See page 62 for outlines and dimensions of snap-fastener terminals.

75-Volt Type
90-Volt Types
300-Volt Type

HOURS OF SERVICE

at 70°F

VS217

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.5 ma.	5 ma.	10 ma.	20 ma.	35 ma.
Contin-uous	41.6	1700	105	40	14	6
	46.8	1620	90	33	12	5
	52	1550	75	27	9.5	3.8
	57.2	1300	55	19	6.5	2.4
	62.4	1000	36	10	4	0.8
2 hrs/ day	41.6	920	150	63	20	7
	46.8	890	140	56	18	6.2
	52	850	130	47	15	5.4
	57.2	810	98	35	11	2.7
	62.4	730	70	21	5.4	0.8

VS090

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.5 ma.	1 ma.	5 ma.	10 ma.	30 ma.
Contin-uous	48	1700	820	105	40	7.5
	54	1620	740	90	33	6.5
	60	1550	650	75	27	5
	66	1300	530	55	19	3.2
	72	1000	390	36	11	1.5
2 hrs/ day	48	920	630	150	63	9.5
	54	890	590	140	56	8.5
	60	850	550	130	47	7.5
	66	810	480	98	35	4.4
	72	730	410	70	21	1.5

VS219

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.6 ma.	1 ma.	2.5 ma.	5 ma.	10 ma.
Contin-uous	48	1070	640	215	80	27
	54	1000	580	180	64	19
	60	940	540	165	50	13
	66	880	500	145	43	10
	72	800	435	125	35	8
4 hrs/ day	48	860	560	225	105	43
	54	845	540	215	95	40
	60	820	520	200	90	36
	66	800	490	180	75	30
	72	780	450	150	60	22

VS316

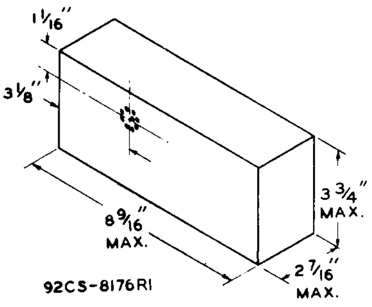
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	10 ma.	20 ma.	35 ma.
Contin-uous	48	820	105	40	14	6
	54	740	90	33	12	5
	60	650	75	27	9.5	3
	66	530	55	19	6.5	2.4
	72	390	36	10.5	4	0.8
2 hrs/ day	48	630	150	63	20	7
	54	590	140	56	18	6
	60	550	130	47	15	5.5
	66	480	98	35	11	2.7
	72	410	70	21	5.5	0.8

VS093

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		0.1 ma.	0.5 ma.	1 ma.	2 ma.	5 ma.
12 hrs/ day	160	1710	320	140	62	20
	180	1615	295	130	53	16
	200	1525	275	117	45	10
	220	1430	255	105	40	9
	240	1345	220	88	32	4
2 hrs/ day	160	1300	320	150	74	24
	180	1265	310	144	68	21
	200	1210	295	138	64	18
	220	1130	275	130	59	15
	240	1100	250	115	50	5

RCA TYPE	SECTION	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
					ASA Type	Units	Arrangement		
6—7.5—75-VOLT BATTERY PACK									
VS050	A	0–50	3 lbs 9 oz.	Leclanché	CD	5	Series	Plug-In Socket (ASA No. XIV)	Voltage taps at +6 and +7.5 volts with common negative terminal—For use in portable electron-tube receivers
	B	0–12			F70	50	Series		
7.5—75-VOLT BATTERY PACK									
VS060	A	0–50	2 lbs 12 oz.	Leclanché	CD	5	Series	Plug-In Socket*	For use in portable electron-tube receivers
	B	0–12			*	52	Series		
1.5—90-VOLT BATTERY PACKS									
VS022	A	0–300	16 lbs 4 oz.	Leclanché	6	3	Parallel	Plug-In Socket (ASA No. XIII)	For use in home electron-tube receivers
	B	0–12			F100	60	Series		
VS064	A	0–300	2 lbs 7 oz.	Leclanché	CD	4	Parallel	Plug-In Socket (ASA No. XIII)	For use in portable electron-tube receivers
	B	0–14			F60	60	Series		

DIMENSIONAL OUTLINES



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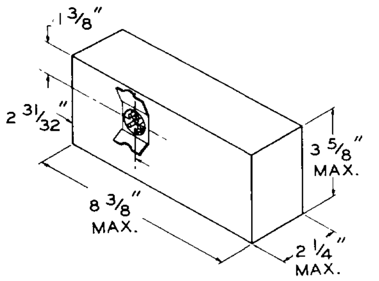
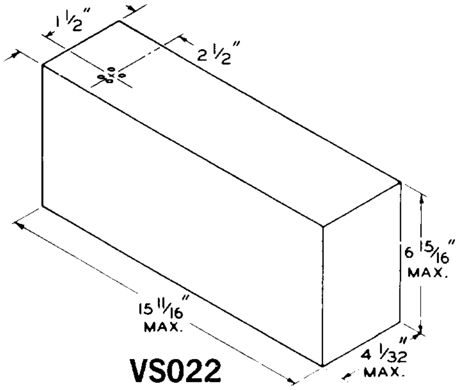


VS060 92CS-8687R1



VS022

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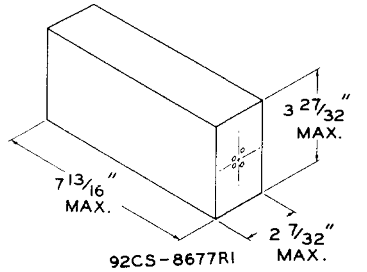
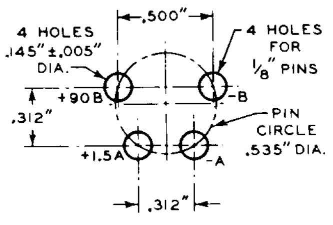
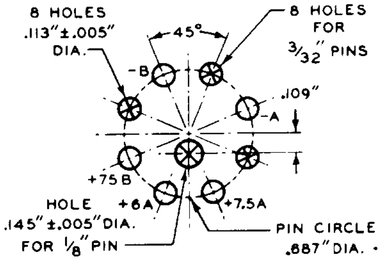


VS064

SOCKET PATTERNS



VS022 VS064



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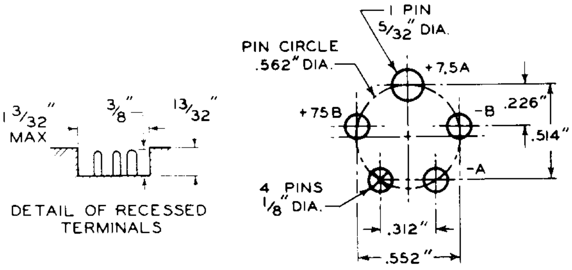


VS060

*No comparable ASA number.

HOURS OF SERVICE

at 70°F

VS050 ("A" Section)

Duty Cycle	End-point Volts*	End-point Volts△	Average Service Hours At Indicated Initial Current Drains			
			60 ma.			
4 hrs/ day	4.5	3.6	95			
	5	4	85			
	5.5	4.4	65			

* For 7.5-volt tap.
△ For 6-volt tap.

VS050 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	5 ma.	10 ma.	20 ma.	40 ma.
4 hrs/ day	40	410	255	100	34	9.5
	45	380	220	85	28	7.5
	50	350	195	72	23	6
	55	310	165	58	17	3.4
	60	210	110	35	9	1.8

VS022 ("A" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		300 ma.				
4 hrs/ day	1	700				
	1.1	600				

VS022 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	30 ma.	50 ma.
4 hrs/ day	48	1600	750	350	200	110
	60	1250	580	230	135	72
	66	900	410	170	100	56

VS060 ("A" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		60 ma.				
4 hrs/ day	4.5	95				
	5	85				
	5.5	65				

VS060 ("B" Section)

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			10 ma.			
2 hrs/ day	40	7500	130			
	50	7500	100			

VS064 ("A" Section)

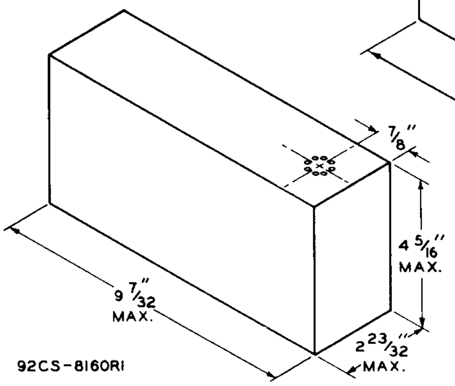
Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		240 ma.				
4 hrs/ day	0.9	95				
	1	85				
	1.1	65				

VS064 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	5 ma.	10 ma.	20 ma.	40 ma.
4 hrs/ day	48	410	255	100	34	9.5
	54	380	220	85	28	7.5
	60	350	195	72	23	6
	66	310	165	58	17	3.4
	72	210	110	35	9	1.8

RCA TYPE	SECTION	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
					ASA Type	Units	Arrangement		
7.5—9—90-BATTERY PACKS									
VS019	A	0-50	4 lbs 12 oz.	Leclanché	F	6	Series	Plug-In Socket (ASA No. XIV)	Voltage taps at +7.5 and +9 volts with a common negative terminal—For use in portable electron-tube receivers
	B	0-15			F70	60	Series		
VS057W	A	0-50	2 lbs 14 oz.	Leclanché	CD	6	Series	Plug-In Socket (ASA No. XIV)	Voltage taps at +7.5 and +9 volts with a common negative terminal—For use in portable electron-tube receivers
	B	0-12			F60	60	Series		
VS119	A	0-50	14 lbs 12 oz.	Leclanché	F	18	Series-Parallel	Plug-In Socket (ASA No. XIV) and Recessed Plug* (4 terminals)	Voltage taps at +7.5 and +9 volts with a common negative terminal--For use in home electron-tube receivers
	B	0-12			F100	60	Series		

DIMENSIONAL OUTLINES



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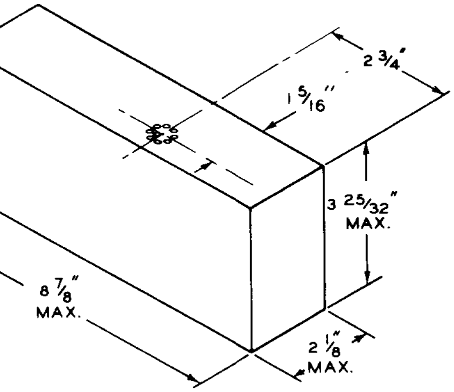
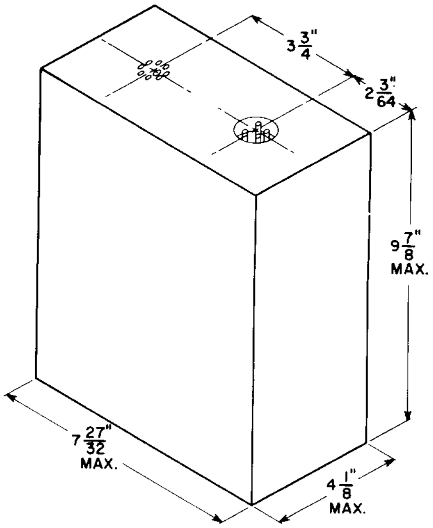


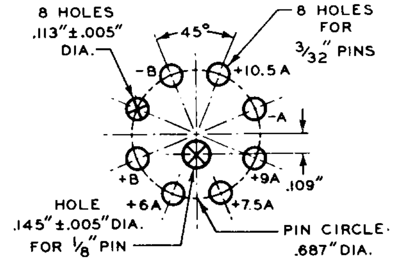
92CS-8181R1

VS057W

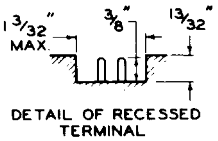


VS119

SOCKET PATTERNS



VS019 VS057W VS119



VS119

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*No comparable ASA number.

HOURS OF SERVICE

at 70°F

VS019 ("A" Section)

Duty Cycle	End-point Volts*	Average Service Hours At Indicated Initial Current Drains 10 ma.	20 ma.	30 ma.	100 ma.	300 ma.
Contin-uous	4.8	1200	550	350	84	18
	5.4	1050	470	275	70	14
	6	940	390	250	55	11
	6.6	880	335	220	40	6.5
	7.2	620	260	155	25	4
4 hrs/ day	4.8	940	475	320	90	19
	5.4	880	425	275	75	15
	6	840	400	260	56	12
	6.6	760	335	235	44	8.5
	7.2	680	300	180	36	4

* Approx. battery life at endpoint voltages of 4, 4.5, 5, 5.5, and 6 volts when used with 7.5-volt tap is the same as endpoint voltages 4.8, 5.4, 6, 6.6, and 7.2 volts respectively.

VS057W ("A" Section)

Duty Cycle	End-point Volts*	End-point Volts△	Average Service Hours At Indicated Initial Current Drains 60 ma.			
4 hrs/ day	5.4	4.5	95			
	6	5	85			
	6.6	5.5	65			

* For 9-volt tap.
△ For 7.5-volt tap.

VS019 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains 5 ma.	10 ma.	20 ma.	40 ma.	80 ma.
Contin-uous	48	430	165	60	23	8.5
	54	380	145	51	19	7
	60	325	116	40	14	5
	66	265	95	31	9	2.5
	72	175	60	18	4.6	1.1
4 hrs/ day	48	455	235	100	34	10
	54	425	210	86	29	9
	60	380	180	69	22	6
	66	330	152	54	14	3.5
	72	265	115	35	8.5	1.7

VS057W ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains 3 ma.	5 ma.	10 ma.	20 ma.	40 ma.
Contin-uous	48	350	165	62	23	8
	54	305	145	52	19	6.5
	60	255	120	42	15	5
	66	215	100	34	11	3.4
	72	160	75	25	7	1.8
4 hrs/ day	48	410	255	100	34	9.5
	54	380	220	85	28	7.5
	60	350	195	72	23	6
	66	310	165	58	17	3.4
	72	210	110	35	9	1.8

VS119 ("A" Section)

Duty Cycle	End-point Volts*	Average Service Hours At Indicated Initial Current Drains 30 ma.	60 ma.	90 ma.	300 ma.	900 ma.
Contin-uous	4.8	1200	550	350	84	18
	5.4	1050	470	275	70	14
	6	940	390	250	55	11
	6.6	880	335	220	40	6.5
	7.2	620	260	155	25	4
4 hrs/ day	4.8	940	475	320	90	19
	5.4	880	425	275	75	15
	6	840	400	260	56	12
	6.6	760	335	235	44	8.5
	7.2	680	300	180	36	4

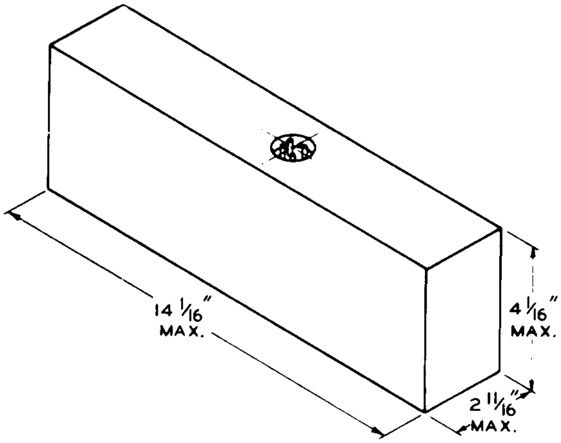
* Approx. battery life at endpoint voltages of 4, 4.5, 5, 5.5, and 6 volts when used with 7.5-volt tap is the same as endpoint voltages 4.8, 5.4, 6, 6.6, and 7.2 volts respectively.

VS119 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains 5 ma.	10 ma.	20 ma.	30 ma.	50 ma.
Contin-uous	48	1600	700	280	170	90
	60	1350	540	210	125	65
	66	1000	380	140	80	40
2 hrs/ day	48	920	540	300	200	110
	54	860	480	275	170	95
	60	800	440	245	150	80
	66	715	380	200	130	60
	72	600	300	140	85	38

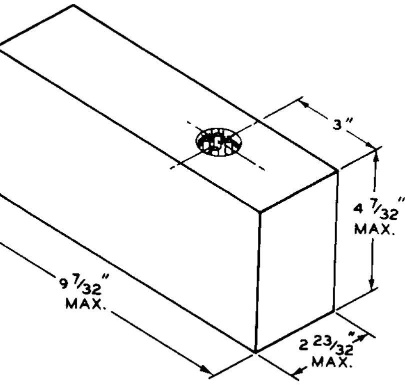
RCA TYPE	SECTION	SUGGESTED CURRENT RANGE ma.	WEIGHT Approx.	CLASS	CELLS			TERMINALS	REMARKS
					ASA Type	Units	Arrangement		
9—90-VOLT BATTERIES									
VS047	A	0-50	6 lbs 2 oz.	Leclanché	G	6	Series	Recessed Plug* (4 terminals)	For use in portable electron-tube receivers
	B	0-15			F90	60	Series		
VS058	A	0-50	4 lbs 12 oz.	Leclanché	F	6	Series	Recessed Plug* (4 terminals)	For use in portable electron-tube receivers
	B	0-15			F70	60	Series		
VS059	A	0-50	2 lbs 14 oz.	Leclanché	CD	6	Series	Recessed Plug* (4 terminals)	For use in portable electron-tube receivers
	B	0-12			F60	60	Series		

DIMENSIONAL OUTLINES



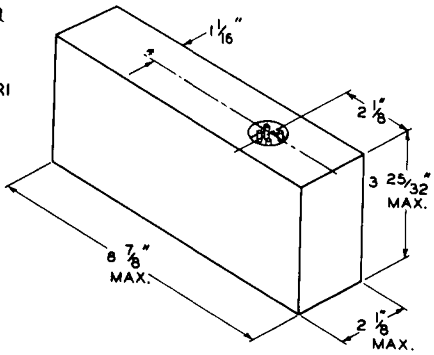
92CS-8173R1

VS047



92CS-8184R1

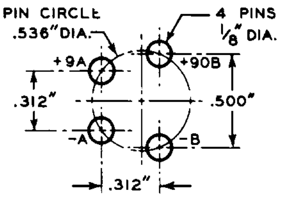
VS058



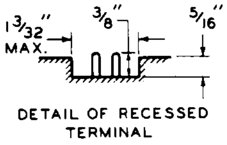
VS059

92CS-8686R1

SOCKET PATTERNS

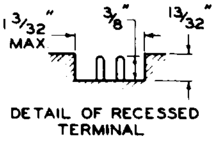


VS047 VS058 VS059



DETAIL OF RECESSED TERMINAL

VS047 VS058



DETAIL OF RECESSED TERMINAL

VS059

No comparable ASA number.

HOURS OF SERVICE

at 70°F

VS047 ("A" Section)

Duty Cycle	End-point Volts	Battery Load Ohms	Average Service Hours At Indicated Initial Current Drains			
			60 ma.			
4 hrs/ day	5.4	150	224			
	6	150	203			
	6.6	150	174			

VS047 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		1 ma.	5 ma.	20 ma.	40 ma.	80 ma.
4 hrs/ day	48	1650	520	138	50	15
	54	1500	470	120	43	12
	60	1300	395	96	32	8
	66	1140	320	70	22	3.3
	72	920	240	45	9.5	1.3

VS058 ("A" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		10 ma.	20 ma.	30 ma.	100 ma.	300 ma.
Contin-uous	4.8	1200	550	350	84	18
	5.4	1050	470	275	70	14
	6	940	390	250	55	11
	6.6	880	335	220	40	6.5
	7.2	620	260	155	25	4
4 hrs/ day	4.8	940	475	320	90	19
	5.4	880	425	275	75	15
	6	840	400	260	56	12
	6.6	760	335	235	44	8.5
	7.2	680	300	180	36	4

VS058 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		5 ma.	10 ma.	20 ma.	40 ma.	80 ma.
Contin-uous	48	430	165	60	23	8.5
	54	380	145	51	19	7
	60	325	116	40	14	5
	66	265	95	31	9	2.5
	72	175	60	18	4.6	1.1
4 hrs/ day	48	455	235	100	34	10
	54	425	210	86	29	9
	60	380	180	69	22	6
	66	330	152	54	14	3.5
	72	265	115	35	8.5	1.7

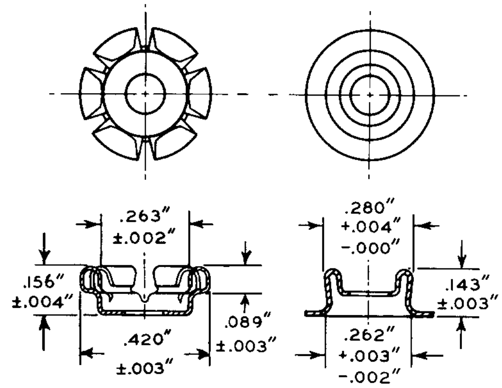
VS059 ("A" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		60 ma.				
4 hrs/ day	5.4	95				
	6	85				
	6.6	65				

VS059 ("B" Section)

Duty Cycle	End-point Volts	Average Service Hours At Indicated Initial Current Drains				
		3 ma.	5 ma.	10 ma.	20 ma.	40 ma.
4 hrs/ day	48	410	255	100	34	9.5
	54	380	220	85	28	7.5
	60	350	195	72	23	6
	66	310	165	58	17	3.4
	72	210	110	35	9	1.8

SNAP-TERMINAL DIMENSIONS

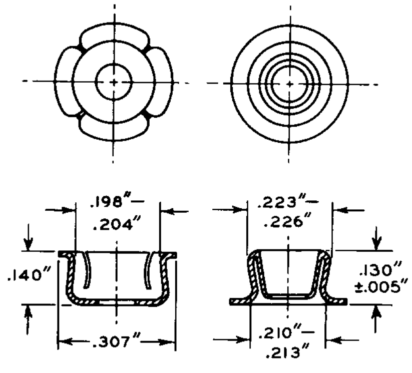


Connectors required: +BS12217•
−BS12302•

ASA No. XV

RCA TYPE

VS016
VS055
VS082
VS090
VS217
VS218
VS219
VS300A
VS306
VS315
VS316
VS322
VS326
VS329

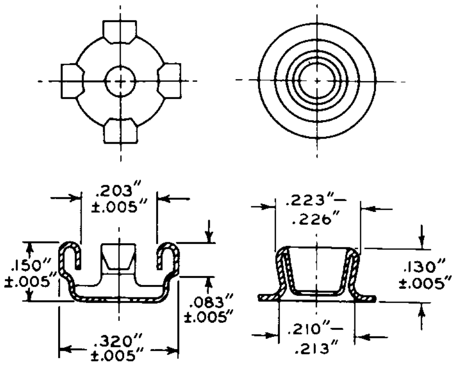


Connectors required: +HS52720•
−BS52719•

ASA No.*

RCA TYPE

VS086
VS312



Connectors required: +HS52784•
−BS52719•

ASA No. XVII

RCA TYPE

VS305
VS309A
VS318
VS323
VS324
VS325

• United-Carr Fastener Corporation or equivalent

* No comparable ASA number.

TECHNICAL PUBLICATIONS

ELECTRON TUBES—

● **RCA ELECTRON TUBE HANDBOOK**—HB-3 (7⅜″ x 5⅝″). Five deluxe 2¼-inch-capacity black binders imprinted in gold. The "bible" of the industry—contains over 5000 pages of loose-leaf data and curves on RCA receiving tubes, transmitting tubes, cathode-ray tubes, picture tubes, photocells, phototubes, camera tubes, ignitrons, vacuum and gas rectifiers, magnetrons, traveling-wave tubes, premium tubes, pencil tubes, and other miscellaneous types for special applications. Available on subscription basis. Price $20.00† including service for first year. Also available with RCA Semiconductor Products Handbook HB-10 at special combination price of $25.00.† Write to Commercial Engineering for descriptive flyer and order form.

● **RCA RECEIVING TUBE MANUAL**—RC-21 (8¼″ x 5⅜″)—480 pages. Revised and expanded. Contains technical data on more than 900 receiving types and 100 picture-tube types. Features tube theory written for the layman, application information and a circuit section. Features lie-flat binding. Price $1.00.*

● **RADIOTRON DESIGNER'S HANDBOOK**—4th Edition (8¾″ x 5½″)—1500 pages. Comprehensive reference thoroughly covering the design of radio and audio circuits and equipment. Written for the design engineer, student, and experimenter. Contains 1000 illustrations, 2500 references, and cross-referenced index of 7000 entries. Edited by F. Langford-Smith of Amalgamated Wireless Valve Company Pty. Ltd. in Australia. Price $7.00.*

● **RCA POWER TUBES**—PG-101E (10⅞″ x 8⅜″)—46 pages. Technical data and selection information on over 200 RCA vacuum power tubes, rectifier tubes, thyratrons, and ignitrons. Price 75 cents.*

● **RCA RECEIVING-TYPE TUBES FOR INDUSTRY AND COMMUNICATIONS**—RIT-104B (10⅞″ x 8⅜″)—32 pages. Technical data on over 190 RCA "special red" tubes, premium tubes, nuvistors, computer tubes, pencil tubes, glow-discharge tubes, small thyratrons, low-microphonic amplifier tubes, traveling-wave tubes, and other special types. Price 30 cents.*

● **RCA RECEIVING TUBES AND PICTURE TUBES**—1275K (10⅞″ x 8⅜″)—64 pages. New, enlarged, and up-to-date booklet contains classification chart, application guide, characteristics chart, and base and envelope connection diagrams on more than 1050 entertainment receiving tubes and picture tubes. Price 50 cents.*

● **RCA INTERCHANGEABILITY DIRECTORY OF INDUSTRIAL-TYPE ELECTRON TUBES**—ID-1020C (10⅞″ x 8⅜″)—16 pages. Lists more than 1450 basic type designations for 18 classes of industrial tube types; shows the RCA Direct Replacement Type or the RCA Similar Type, when available. Price 35 cents.*

● **RCA PHOTOSENSITIVE DEVICES AND CATHODE-RAY TUBES**—CRPD-105B (10⅞″ x 8⅜″)—36 pages. Technical information on 151 RCA tubes including single-unit, twin-unit, and multiplier phototubes; photocells; camera and image-converter tubes; flying-spot tubes; monitor, projection, transcriber, and view-finder kinescopes; oscillograph and storage tubes. Price 50 cents.*

● **RCA PHOTOCELLS**—1CE-261 (10⅞″ x 8⅜″)—20 pages. Contains a selection of photocell-circuit diagrams; technical data and characteristic curves of RCA photoconductive, photojunction, and photovoltaic cells; interchangeability information; and supplementary information on tungsten and fluorescent light sources. Booklet is designed to introduce the engineer, the hobbyist, and the experimenter to application possibilities of RCA photocells. Price 25 cents.*

● **RCA MAGNETRONS AND TRAVELING-WAVE TUBES**—MT-301A (10⅞″ x 8⅜″)—48 pages. Operating theory for magnetrons and traveling-wave tubes, application considerations, and techniques for measurement of electrical parameters. Price 60 cents.*

● **RCA PENCIL TUBES**—1CE-219 (10⅞″ x 8⅜″)—28 pages. Contains operating theory for pencil tubes, electrical and mechanical circuit-design considerations, environmental considerations, application considerations, and data for commercial types. Price 50 cents.*

● **RCA PHOSPHORS**—TPM-1508A (10⅞″ x 8⅜″)—20 pages. Contains defining data for over 25 different industrial phosphors, spectral-energy emission curves, persistence curves, and quick-reference classification charts. Price 75 cents.*

● **RCA CAMERA TUBES**—1CE-262 (10⅞″ x 8⅜″)—24 pages. Technical information on RCA image orthicons and vidicons aimed at helping the camera tube user select the most appropriate tube for his application. Includes concise data on all commercially available RCA camera tubes as well as typical curves and information defining the most important characteristics of camera tubes. Also contains cutaway views of a vidicon and image orthicon illustrating construction features. Price 75 cents.*

● **RCA TRIPLE PINDEX**— PINDEX-109 (8¼″ x 5¼″)—240 pages. Gives base diagrams for more than 2000 JEDEC-registered receiving types including picture tubes. Base diagrams of over 1500 receiving types are presented in triplicate to provide the user with any three base diagrams at any one time. More than 200 small industrial-receiving types and more than 200 foreign receiving types are cross-referenced to the receiving-tube section for base diagrams. Price $1.75.*

● **RCA INTERCHANGEABILITY DIRECTORY OF FOREIGN vs. U.S.A. RECEIVING-TYPE ELECTRON TUBES**—1CE-197B (8⅜″ x 10⅞″)—8 pages. Covers approximately 800 foreign tube types used principally in AM and FM radios, TV receivers, and audio amplifiers. Indicates U.S.A. direct replacement type or similar type if available. Price 10 cents.*

● **RCA HIGH-FIDELITY AMPLIFIER CIRCUITS BOOKLET**—HF-110 (8⅜″ x 10⅞″)—28 pages. Includes circuit diagrams with parts lists, design considerations and performance requirements, and characteristics chart of RCA high-fidelity tube types. For hobbyists, technicians, and others interested in construction of their own high-fidelity amplifier systems. Price 35 cents.*

● **RCA COLOR TELEVISION PICT-O-GUIDE**—(9⅝″ x 5⅜″)—200 pages. Developed and written by John R. Meagher, RCA's nationally recognized authority on practical TV servicing. Prepared to aid TV technicians in trouble-shooting and adjusting color TV receivers. Color photographs are included to assist in recognizing and understanding visible symptoms of troubles and misadjustments. Price $4.50.*

● **TV SERVICING**—TVS-1030 (10⅞″ x 8⅜″)—48 pages. Contains articles on TV trouble-shooting, TV tuner alignment, and TV circuit analysis by RCA's expert in the field of TV servicing and test equipment—John R. Meagher. Price 35 cents.*

● **TV SERVICING, SUPPLEMENT 1.**—TVS-1031 (10⅞″ x 8⅜″)—12-page booklet by John R. Meagher on solving trouble-shooting problems in those hard-to-service TV receivers known to service technicians as "tough" sets or "dogs". Price 15 cents.*

SEMICONDUCTOR PRODUCTS—

● **RCA SEMICONDUCTOR PRODUCTS HANDBOOK**—HB-10 (7⅜″ x 5⅝″). Two deluxe 2¼-inch-capacity red binders imprinted in gold. Contains over 1000 pages of loose-leaf data and curves on RCA semiconductor devices such as germanium transistors, silicon transistors, silicon rectifiers, and semiconductor diodes. Available on subscription basis. Price $10.00† including service for one year. Also available with RCA Electron Tube Handbook HB-3 at special combination price of $25.00.† Write to Commercial Engineering for descriptive flyer and order form.

● **RCA SEMICONDUCTOR PRODUCTS GUIDE**—60S16R3 (10⅞″ x 8⅜″)—12 pages. Contains classification chart, index, and ratings and characteristics on RCA's line of transistors, silicon rectifiers, semiconductor diodes, and photocells. Single copy free on request.

● **RCA SILICON POWER TRANSISTORS APPLICATION GUIDE**—1CE-215 (10⅞″ x 8⅜″)—28 pages. Describes outstanding features of RCA silicon power transistors and their use in many critical industrial and military applications. Includes construction details, discussion of voltage ratings, thermal stability conditions, and equivalent circuits for these transistors. Price 50 cents.*

● **RCA SILICON VHF TRANSISTORS APPLICATION GUIDE**—1CE-228 (10⅞″ x 8⅜″)—20 pages. Describes unique capabilities of RCA silicon vhf transistors and their use in critical industrial and military applications up to 300 Mc. Price 50 cents.*

● **TRANSISTORIZED VOLTAGE REGULATORS APPLICATION GUIDE**—1CE-254 (10⅞″ x 8⅜″)—12 pages. Describes and discusses transistorized voltage regulators of the series and shunt types. Included are design considerations, step-by-step design procedures, and the solutions to sample design problems. An Appendix contains the derivation of design equations. Price 25 cents.*

BATTERIES—

● **RCA BATTERY MANUAL**—BDG-111 (10⅞″ x 8⅜″)—64 pages. Contains information for the designer, application engineer, experimenter, and student on dry cells and batteries [carbon zinc (Leclanché), mercury, and alkaline types]. Included in this manual are battery theory and applications, detailed electrical and mechanical characteristics, a classification chart, dimensional outlines and terminal connections on each battery type. Price 50 cents.*

● **RCA BATTERIES**—BAT-134E (10⅞″ x 8⅜″)—16 pages. Technical data on 106 Leclanche, alkaline, and mercury-type dry batteries, for radios, industrial applications, flashlights, lanterns, electronic toys, and for photoflash service. Price 35 cents.*

● **RCA BATTERIES FOR TRANSISTOR APPLICATIONS**—TBA-107A (10⅞″ x 8⅜″)—12 pages. Technical data and curves on 25 RCA Leclanche-and-mercury-type dry batteries specifically designed for use in applications utilizing transistors. Price 25 cents.*

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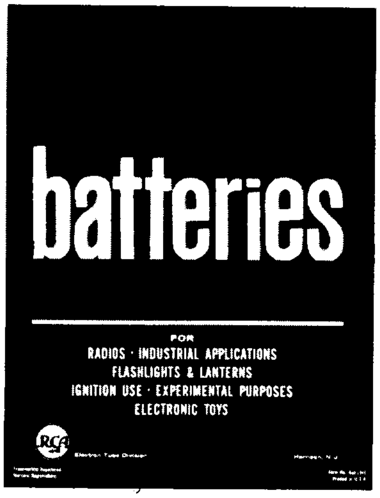
† Prices shown apply in U.S.A. and are subject to change without notice.

* Optional list prices—apply in U.S.A. and are subject to change without notice.

Other **RCA** technical publications

Information on the publications illustrated and a listing of other RCA Technical Publications is given on the preceding page.

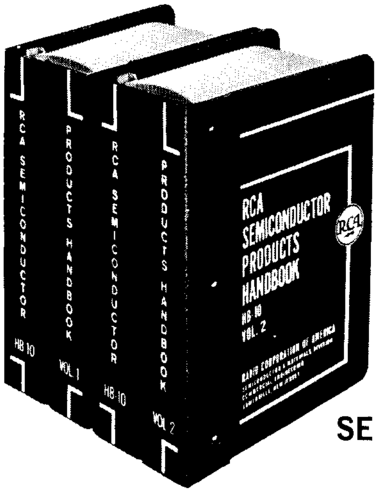
ELECTRON TUBE HANDBOOK HB-3


batteries

FOR
RADIOS · INDUSTRIAL APPLICATIONS
FLASHLIGHTS & LANTERNS
IGNITION USE · EXPERIMENTAL PURPOSES
ELECTRONIC TOYS

RCA Electron Tube Division

BATTERY CATALOG BAT-134E


RCA SEMICONDUCTOR PRODUCTS HANDBOOK
HB-10
VOL. 2
RADIO CORPORATION OF AMERICA

SEMICONDUCTOR PRODUCTS HANDBOOK HB-10

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